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# THE CONNEXION

OF

# NATURAL AND DIVINE TRUTH;

OR, THE

## STUDY OF THE INDUCTIVE PHILOSOPHY

CONSIDERED AS

## SUBSERVIENT TO THEOLOGY.

BIBLIOTHECA

---

BY

THE REV. BADEN POWELL, M.A., F.R.S., F.G.S.
OF ORIEL COLLEGE,
SAVILIAN PROFESSOR OF GEOMETRY IN THE UNIVERSITY OF OXFORD.

---

LONDON:
JOHN W. PARKER, WEST STRAND.

M.DCCC.XXXVIII

858.

TO THE

# RIGHT REV. EDWARD STANLEY, D.D.

PRES. L. S., F.G.S., &c.,

LORD BISHOP OF NORWICH.

My dear Lord,

In availing myself of your Lordship's permission to dedicate to you the ensuing volume, I am desirous briefly to refer to the grounds on which I made the request, more especially because I feel assured that it is in the very same spirit that that request has been complied with.

The right use and just value of physical science in connexion with the evidences and illustration of religious truth, are topics always demanding serious attention, but more especially in an age like the present, abounding with false pretensions on the one hand; and opposing prejudices on the other. Amid such errors and perversions it is a matter of particular satisfaction when the advocates of reason and truth find their efforts approved and encouraged by those whose situation in the Church silences all cavils; and in no instance is this more gratifying than when those who are now in the position to confer that sanction have themselves previously been labourers in the diffusion and enlargement of the knowledge of nature.

Your Lordship's sentiments on this important subject have been sufficiently evinced, were it only by the part you have taken in that vast Association of British Science which is now yearly exciting so general and powerful an interest in physical pursuits, and by the zeal with which you have there upheld the religious application of true philosophy,—and asserted the revelation of God in the volume of nature as our best guide to the manifestation of Him in the pages of inspiration.

It was from such considerations, that, being engaged in a work having the same great object in view, I was naturally led to look to your Lordship's name as that which above all others would be most appropriately prefixed to it, and most powerfully assist in promoting the important end to which it is designed to be subservient.

I remain,
With the greatest esteem and respect,
My dear Lord,
Most sincerely your's,
BADEN POWELL.

Oxford,
*December* 13, 1837.

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# PREFACE.

WITHIN a few years past, an extraordinary interest has been evinced, and an unusual supply of works produced on subjects relating to the application of Physical Science to Natural Theology; its connexion with revelation, and the influence which physical truths have in guiding us even in the interpretation of Scripture. The train of writers called forth by the Bridgewater bequest; the reproduction of Paley's work, illustrated and prefaced from the resources of a period of advanced knowledge; and the various other publications to which these directly or indirectly have given rise, have together furnished a body of facts and arguments in which it might be supposed every topic would have been exhausted, and nothing left to be desired in the analysis of those evidences on which the fundamental truths of all religion are established. If we look more closely into the nature of the discussion, we however perceive that this is far from being the case. With the majority of writers on natural theology, the mere accumulation of *particular instances* of design from different parts of the natural world, has been almost the sole object of attention; now though it cannot be denied that they have thus most advantageously brought the resources of all branches of science to bear on the question, yet (to whatever source it may be traced), a great deficiency appears to exist to the exact *analysis of principles*, and the philosophy of the argument; of which it must be confessed we meet with frequent instances even among writers of high eminence. The cultivators of physical science, perhaps, have not been generally disposed or qualified to enter upon logical distinctions; while the theological and metaphysical inquirers have too commonly been but little versed in physical evidence, and have thus failed to appreciate and enforce the extent and importance of the great argument from the order and arrangement of physical laws and causes.

To bring united resources of both kinds to bear on the subject has been the professed object of some of the recent publications alluded to. Among these the *Bridgewater Treatise* of Mr. Whewell, the *Discourse* of Lord Brougham, and the *Fragment* of Mr. Babbage, stand conspicuous, especially when the first is taken in connexion with some passages in the *History of the Inductive Sciences* by the same author; and the second, with the *Natural Theology* of Dr. Turton.

Another writer, also, has recently discussed the evidences of natural theology; but with widely different views from any of those just referred to; and to whose treatise (as it has obtained a considerable share of commendation in certain quarters,) I must briefly allude, viz., a work entitled, *The whole Doctrine of Final Causes*, &c., by the Rev. W. J. Irons, of Queen's College, Oxford. London, 1836.

This writer, upon professedly philosophical principles, and by an elaborate metaphysical argument, has undertaken to maintain that a strictly natural theology, logically deduced from the phenomena of creation, is absolutely unattainable.

This position he seeks to maintain for the express object of showing the necessity and all-sufficiency of revelation. He pursues the argument by entering largely into the discussion of the nature of *causes*, examining the opinions, both ancient and modern, on the subject; and after considering the nature of final causes, he at length endeavours to show (upon his previous notion of causes in general,) that the argument from final causes is altogether fallacious and illusory. Hence he proceeds to contend for revelation as the only source of our knowledge, even of the *existence* of a Deity. A work of such pretensions, supported by at least the appearance of extensive research and erudition, has naturally demanded attention. The greater part of these pages was written before I had seen Mr. Irons's publication. However, some parts, as they then stood, I found related so closely to certain portions of that author's argument, that they were already sufficient to explain the grounds of my entire dissent from him. In a few places, as they fell in with the line of my observations, I have since introduced some remarks which will be found to bear on other points of his reasoning.

I must here also add a passing reference to Mr. Babbage's "fragment," *The Ninth Bridgewater Treatise*. To some of the philosophical views developed and illustrated in it, I shall have occasion to refer particularly in the course of the ensuing pages; at present, I merely wish to express my conviction of its *general* value, especially as suggesting rich materials for thought, to every reader capable of turning them to account. I am the more induced to offer this remark, because I am aware that the originality and novelty of the illustrations derived from an abstruse branch of science have not been generally appreciated; and somewhat of singularity in the whole manner and appearance of the volume, has tended, perhaps, to indispose some readers from doing justice to its real excellencies, and even to doubt its tendency.

To return to the general subject: Upon long continued consideration, it has appeared to me that much was still wanting to its complete and satisfactory elucidation, and that several important points relative to the *analysis* of the argument and *nature* of the reasoning, remained untouched, or very imperfectly explained, even by those who have professedly entered more largely upon a discussion of principles. If then the argument has seemed to me to call for such further extension and explanation as in the ensuing pages it is my endeavour to supply, it has been with the fullest appreciation of the numerous excellencies of the writers alluded to that I have engaged in the attempt to supply some of the deficiencies. On points where I feel obliged to differ from them, I have in general avoided specific controversy or criticism, and have usually stated my own views and arguments simply as they arose out of the course of the main discussion, accompanied by a reference which would sufficiently lead those readers who might be interested in it to the comparison of what I have advanced with the views, more or less opposite, of the writers referred to.

My main object is to examine the connexion and relation between the several great branches of the inquiry;—between physical science and natural theology, as also between this and revealed religion; each in succession furnishing the necessary basis of evidence to the next; and again, the independence of each with respect to the succeeding, as essential to the order and force of the reasoning, whilst they yet maintain a close connection with, and reaction upon each other.

Thus, from the very nature of the case it will be apparent to what extent the present publication can have any claims to novelty in its topics. Among the various writers on kindred subjects I have met with none taking precisely the same line, or embracing exactly the same range of subject as that which is proposed to be pursued in the ensuing treatise. Yet almost every one of the different branches of my subject has been more or less discussed by some of the authors alluded to. In many cases my statements are, in fact, no more than an elementary exposition of a particular branch of the subject often treated before by others. Yet I conceive I have best consulted perspicuity and brevity in laying down the principles, as if delivering what was new to the reader, without formally referring him to authors who have treated of it before.

It may perhaps be right to state, that a great part of the argument in the fourth section runs nearly parallel with that of a discourse which I some time since published, intitled, *Revelation and Science;* Oxford, 1833. Also the introductory portion of the first section is a reprint (with a few alterations,) of a paper which I contributed to some early numbers of the *Magazine of Popular Science*, vol. i. 1836.

In the details of examples adduced from different branches of physical science, I have endeavoured, as far as possible, to avoid technicalities, or at least to explain the scientific terms referred to, in the most popular form of illustration of which they appeared susceptible. Indeed throughout in the exposition of the argument, it has all along been made an object to elucidate the principles in the most perspicuous manner which the nature of the subject would admit, and to carry on the discussion in such a form as would be suitable to the general reader.

One further remark must be added. In some of the late critical discussions on natural theology, great stress has been laid (as appears to me very unfairly,) on the *omissions* of certain writers. No author ought fairly to be subject to animadversion for *not* discussing what the peculiar line of argument he has selected does not lead him to discuss. I am therefore particularly desirous of stating that the present work has no pretensions whatever to include a *complete* or systematic treatise on natural theology. Its outline embraces only certain particular questions connected with that science; of a nature, indeed, preliminary and general in one part, and in another supplementaryand discursive; but in neither instance having any claim to be regarded as treating *every* point belonging to the subject. In a word, I wish to be judged of, not by what I do not say, but by what I do.

# INDUCTIVE SCIENCE

AND

# SECONDARY CAUSES,

CONSIDERED AS THE EVIDENCE OF A FIRST CAUSE,
AND THE FOUNDATION OF RELIGIOUS TRUTH.

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## I. THE EVIDENCE AND NATURE OF PHYSICAL TRUTH.

## II. THE APPLICATION OF PHYSICAL TO DIVINE TRUTH.

# INTRODUCTION.

THE study of natural theology cannot be pursued alone, and disjoined from other branches of inquiry. It has a close connexion with the study of physical science on the one hand, and with that of revelation on the other. Whether we dwell upon the nature of the evidences, or upon the truths established, this connexion is equally intimate. The stability of natural theology rests upon the demonstrations of physical truth: and upon the assurance of the great doctrines of natural theology must all proof, and even all notion, of a revelation be essentially founded. This intimate connexion and dependence, however, is by no means generally understood, often questioned, and not unfrequently even disparaged and denied.

In the discussion of the truths of natural theology much difficulty has arisen in some minds, and much misapprehension of the whole nature of the argument. The order and chain of proof, indeed, seems to require but little consideration to render it evident. Yet it is very generally misconceived. That prolific source of mistake, the ambiguity of terms, operates very widely in introducing confusion of thought into all portions of the inquiry. The nature of the proof on which the "theories," as they are often termed, of natural philosophy depend—the distinction between *inductive* conclusions and hypotheses—the relative use and importance of the two—and the consequent nature and security of the basis on which natural theology rests,—are all points on which there seems to me great need of attempts at a better elucidation than is commonly afforded. And in immediate connexion with these topics, the relation in which the scripture stands to philosophy, (especially where its expressions may be opposed to the conclusions of science,) is a point most pre-eminently requiring to be better explained.

By all thinking inquirers, indeed, the importance of the study of nature as subservient to the great argument of natural theology, is generally admitted; and the evidences which it affords are for the most part such as address themselves powerfully to the conviction even of the least instructed inquirer. And it is not one of the least weighty considerations in favour of the same great inferences, that their evidences are of a nature in some way appreciable by minds of all classes and constitutions, and of all degrees of cultivation. The most cursory survey of nature inspires reflections of the same high tendency in the most illiterate, as the profoundest investigation does in the most philosophical. And the more closely and accurately the phenomena are scrutinized and reduced under general laws, the more powerful is the weight of the evidence, to every intellect prepared to profit by such inquiry. To supply all the detail of such proofs, drawn from the innumerable particular cases evincing design and arrangement in the material world, has been the object of the labours of a long and distinguished series of writers.

But however manifest may be the particular proofs which reflection deduces from the observed order of nature,—however clear the varied features of the view presented to our contemplation by a closer survey, yet no small degree of confusion and perplexity often prevails, as to the distinct grounds and order of the reasoning.

And however elaborately followed up the details may have been, much still seems requisite in elucidation of the great principles of the inquiry. And in a searching and inquiring age, it becomes more peculiarly needful to analyze the nature of our evidence; and to be able, with that confidence which belongs to a good and just cause, to meet any scrutiny, and to challenge any fair inquiry, into the grounds of our convictions; for which we can be duly prepared only by going fearlessly into the more precise examination of the actual principles which are involved in the reasoning.

It has been well observed by Dr. Turton, "Natural theology . . . . . . *is*, in fact, natural philosophy—physical science in its utmost extent—studied with especial attention to the marks of design, which are in succession furnished by the objects of inquiry*." It has also been emphatically and eloquently said, by another writer of the present day, "The study of natural philosophy and natural theology, if rightly pursued, are one; and true science but a perpetual worship of God in the firmament of his power†."

Now the object of the ensuing discussion is precisely to show *how* and *why*, this is the case; *in what sense*, and *on what grounds*, the identity of the two can be maintained. And by carefully analyzing the nature of our impressions and convictions, to render more secure the steps by which we ascend to these sublime truths; and to expose more fully the errors and inconsistences by which such advance is too often impeded, the proper relation and dependence of the several parts and stages of the inquiry disturbed, and the connexion and force of the whole broken and destroyed.

The importance and precise office of physical science in the support of Divine truth, altogether, has been too commonly overlooked, or misunderstood; and often so totally misconceived as to give rise to the most unhappy prejudices and lamentable hostility against it.

According to views of the subject, not only popularly received, but even supported by the sanction of religious authority, the entire order and tendency of the inquiry seems to be wholly mistaken and inverted.

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* *Natural Theology*, p. 39.

† *Magazine of Popular Science*, vol. i. p. 41.

Natural philosophy is considered to engage the mind in the study of what are termed "second causes:" such inquiries are supposed to have a direct tendency to withdraw the thoughts from the "first cause." It is, therefore, the business of natural theology to remedy this evil: though even natural theology is incompetent entirely to produce the desired effect; and the authority of Revelation must be called in to check the vain inquiries of reason; which, indeed, it is generally safer and better to avoid, and condemn altogether.

Such is the confusion of ideas very commonly prevalent; and which it is even considered impious to attempt to expose!

Yet, at the hazard of offending all such prejudices, I shall proceed to an unshrinking examination of the real order and connexion of the evidences of physical science, natural theology, and Revelation, as mutually dependent upon and affecting each other.

That illiterate fanatics should inveigh with all the bitterness of sincere bigotry against the cultivation of science, is less a matter of surprise than of pity. But to find a similar course pursued by those who are the professed disciples of a purer and more rational creed, must be a subject of deep regret to every friend of truth. To find sentiments derogatory to the use of reason and the cultivation of the intellect, coming from those who, by learning, station, and character, ought to be the friends and advocates of all sound and rational acquirements; to hear the condemnation of physical research, as beset with danger to religion, from those who ought to know its value as the sole basis of natural theology, must, under any circumstances, be regretted, not only by the advocates of science as such, but above all, by the real friends of religion.

To that unfortunate deficiency in our systems of public education, by which physical science is practically excluded, or, at best, degraded to a very secondary rank, we must ascribe the deplorably low views of its nature and value which pervade the writings of many, who, in other respects, are among the brightest ornaments of the Church and the Universities. They are perpetually representing these pursuits as solely concerned with the dominion of man over the material elements, and solely applied, or applicable, to the arts of life. Thus incompetent to appreciate the high intellectual and moral influence of a devotion to the study of nature, they are sometimes led, not only to deny such influence, but even to accuse these pursuits of a tendency opposed to all religious impressions.

No effectual remedy for such a state of things will probably be found until physical science shall be duly recognised as an *essential* branch of a liberal education, especially in the Universities. So long as the public in general are unable to judge of scientific pretensions, philosophy will be degraded by the pretensions of quackery: and this will give a colour to the accusations of bigotry: the public mind will be imposed upon by the misrepresentations of crafty Jesuitism, or the declamations of blind fanaticism. To expose such mischievous errors is one main object of the ensuing pages.

But it is to be hoped that this state of things may not continue. It is to be hoped on every account, for the sake of society itself, as well as of science; for the sake of the general intellectual improvement of mankind, as well as of the encouragement of research; and above all, for the sake of the moral and religious influence which true science never can fail to secure as affording the sole rational foundation of natural theology, and by consequence of all further religious truth.

And if, as indeed there seems abundant promise may before long be the case, the course of public opinion shall take a direction in accordance with the just claims of physical science, how infinitely more pernicious will it be that this absurd and unhappy hostility should be cherished and kept up, on the part of those who ought to be the ministers and disseminators of truth.

To expose, then, such mischievous errors as those just adverted to, to explain the real bearing of physical science, and vindicate its essential services to natural theology, and in its consequences to revealed religion also, forms a main object of my discussion. The attainment of this object requires a closer examination into some of the first principles of the subject, to which too little attention has hitherto been paid, and this brings us into close connexion with the essential nature of the great rules of induction, as established and explained by their illustrious propounder: and more especially as contrasted with the sources of false philosophy, and erroneous theory, which he has happily designated and classified under the name of "Idola;" (the false divinities which the mind is apt to raise as the objects of its worship, and at whose shrine truth is often sacrificed;)—a portion of his argument, which is found more full of valuable instruction, the more extensively it is examined and applied.

THE

# EVIDENCE AND NATURE

OF

# PHYSICAL TRUTH.

---

## I. EVIDENCE OF PHYSICAL TRUTH.
## THE INDUCTIVE METHOD.

## II. NATURE OF PHYSICAL TRUTH.
## CAUSE AND EFFECT.

# SECTION I.

## EVIDENCE OF PHYSICAL TRUTH.
## THE INDUCTIVE METHOD.

"There is a certain analogy, constancy, and uniformity, in the phenomena or appearances of nature, which are a foundation for general rules; and these are a grammar for the understanding of nature, or that series of effects in the visible world, whereby we are enabled to foresee what will come to pass in the natural course of things."
BISHOP BERKELY, (*Siris*, p. 120.)

"Usque adeo natura, una eadem semper atque multiplex, disparibus etiam formis, effectus pares, admirabili quadam varietatum simplicitate, conciliat."
SCARPA.

### *Introduction.*

THE Inductive Philosophy stands forth as the distinguishing boast of modern intellectual advancement, and the prolific source of innumerable advantages,—mental, moral, and physical. It has opened the path now universally recognised as alone leading to the correct interpretation of nature; of that stupendous order of varied existence, and incessant activity of causation, with which we are surrounded and filled. It is justly characterized as a method framed in conformity to experience; and stands essentially opposed to those artificial systems of former ages, which were but the vain chimeras of minds bewildered in the obscurities of verbal mysticism, or deluded by the conceits of gratuitous hypothesis; systems which cramped all energy of thought and invention, and fettered all freedom of opinion and discussion. By a combination of vague and unmeaning abstractions, involved in a pedantic jargon of empty terms, the scholastic disputants thought to settle the order of natural causes, and determine what *must be* the character of physical laws. From a few abstract, and those hardly intelligible, arbitrary positions, they affected to advance, by the mere subtilty of their reasoning powers, to a comprehension of the entire system of the material universe.

But the appeal to experiment and observation, and the high and pure physical philosophy inculcated by Bacon, and practically followed up by Galileo, Newton, and their successors, soon established the dominion of principles, at once more correct and rational, and better suited to the limited range of the human faculties. By the humble unpretending path of the inductive method, all the great triumphs of physical discovery have been achieved; by a steady adherence to its principles, can we alone expect the further extension of natural knowledge; and so long as they are adhered to, we can assign no limit to the progressive advance which may be made. And minds duly impressed with the sublimity of those inquiries which the contemplation of the universe suggests, will easily recognise the truth and value of this method. They perceive, in the reference to observation and experience, an appeal to the sole authority of nature: they would interrogate her in her own language, and in the replies to those interrogatories, afforded by experimental results, acknowledge the only real testimony to physical truth; the only means by which the laws of the material world can be successfully elicited and established; and by which simplicity and order are educed out of the vast mass and (as might appear) inextricable complexity of accumulated phenomena.

The claims of the Inductive Philosophy are indeed now generally allowed, and its praises held forth; still, not unfrequently, even its advocates and encomiasts entertain very indistinct notions of the real nature of the system they support, and it becomes the more necessary to examine carefully *the nature of the reasoning*, and the general *grounds of the evidence*, by which experimental laws, and physical truths, are substantiated; and this, in fact, is what is meant by the expressions so commonly used, "the inductive method," "the inductive logic," "experimental evidence," and the like. The object of the present section is to analyze their meaning, and endeavour to exemplify and elucidate the nature of our convictions and inferences, in these branches of knowledge; the degree of certainty of which they are susceptible; and the sources of failure and error to which we are most exposed in the prosecution of physical inquiry, without some well-grounded principles of this kind as our guide. And without restricting ourselves to too formal and technical a method, to examine briefly the *real nature* of the inductive process: and to illustrate, by familiar examples, wherein the most essential and characteristic features of *inductive* evidence consist, as distinguished on the one hand from the mere evidence of our senses, and on the other from demonstration.

### *Meaning and Nature of Induction.*

At the present day, so common is the use of the term "Inductive Philosophy," that, it may be presumed, there are few persons who have not at least some apprehension of the sort of investigation which it is used to designate.

In its more general signification, this term is employed to describe the entire method of modern physical science, as peculiarly characterized by resting on the appeal to experiment and observation alone; and as contra-distinguished from the scholastic systems, which proposed to reason downwards from abstract principles to natural laws and phenomena: the inductive, on the contrary, ascends from observed phenomena to general laws and abstract principles.

In its more limited sense, however, "induction" is understood to signify the process of inferring and collecting general results, general facts, or "laws," from a number of particular instances, carefully established on actual experimental evidence. It is the nature of the process, thus designated, and the principles on which it is conducted, that we propose to explain and comment upon.

Now, it is clear that the first step in such a process, must be the collection and classification of a number of particular phenomena: the careful examination of a number of individual cases, in order to discover some common property or circumstance in which they all agree, amid many others in which they differ*.

Does then the process consist merely in this, that we examine *every* individual of a class, or number of objects before us, and, finding each one to possess a particular property, affirm that as a common property of the class? This, certainly, would imply no exercise of reasoning, and would hardly be worthy the name of induction. We should be merely affirming a proposition for whose truth we had the direct evidence of our senses. Yet perhaps among cases even of this sort, there may exist much difference as to the extent and labour of the research we may have to go through, in detecting the one property, which is common to all the individual cases, and constitutes the characteristic by which we give them a common classification and a generic name. The point in which all the examined instances agree, may, indeed, be manifest at first sight. But, again, it may be far otherwise; and though we have all the cases before us, (especially if they be numerous,) it may yet require no small labour and skill to succeed in tracing out what the property or circumstance is in which they all agree, amidst a variety of others in which they differ. The first case requires nothing further than the bare inspection of the instances.

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* This " bringing in," as it were, of fresh testimony, and corroborating witnesses, was probably the original idea of " inductio," or ἐπαγωγὴ.

The latter may call forth much discriminative skill. The former is the work of the mere collector: the latter may involve that of the philosopher. But in any case other than the most immediately obvious, there is this to be remarked; and it is deserving of particular attention: it is almost certain that, in the first instance, the mind will conjecturally fix upon some property, which is imagined (whether correctly or not) most likely to be the common one sought, long before a complete examination of all the individuals has taken place*.

Let us suppose, on the other hand, that we have *not all* the individual facts before us. We observe a certain number of them, and finding them agree in some property, we are almost invariably prone at once to infer, that all the rest possess it likewise. We infer more than we see. There is certainly a strong natural tendency in the human mind (even upon very slight apparent grounds) to advance from individual facts to general conclusions,—to hazard inferences from the known to the unknown.

## *Grounds of Inductive Conclusion.*

We have then next to inquire with what reasonable confidence can we make such inference? For instance, suppose that feeling a number of balls in a bag, we take out a few, and, finding them white, infer that all the balls in the bag are white: is this a legitimate induction? Is it correct reasoning; is it not rather a most groundless presumption? Yet it may be asked, does it not possess all the characteristics of induction, as they have been laid down by some logical writers? For wherein does the case we have supposed, differ from their commonly cited example: "This, that, and the other loadstone, attracts iron,—therefore all loadstones do?" Or why is not the former of these instances as good reasoning as the latter?

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* See Sir John Herschel's *Introductory Discourse on Natural Philosophy*, p. 165.

In the case of the balls, we cannot assign or imagine any reason why one should be white because others are so; any supposable connexion between the circumstance of the balls being together in the bag, and their colour. There is no tendency to fancy or expect it. On the other hand, in the case of the loadstone, having observed the effect, in a few instances, we feel a natural tendency to imagine that the same magnetic property subsists whenever we perceive the same external characteristics. We cannot avoid being persuaded that there is a connexion between that particular darkness of colour, weight, hardness, texture, &c., by which we recognise the mineral, and a magnetic power, though we may be at a loss to explain or assign the ground for it.

Yet the only thing which seems at all to warrant the induction from a limited number of instances, is the *reasonableness* of such an intuitive persuasion. When, therefore, we have only a limited number of instances, which we can examine (and such is the case, in fact, in almost all physical inquiries,) no inductive inferences can properly be made, unless we feel assured of some probable ground for expecting a common connexion to subsist between the individual cases. Can we, then, succeed in tracing any probable principle to which the existence of such a persuasion may be traced?—Can we analyse it up to any rational ground of belief? This is a most important point of our inquiry; and to it our attention must next be directed. (See Note A.)

### *Belief in the Uniformity of Nature.*

Now there is one grand, fundamental principle, without which no induction of laws from particular instances, no generalizations of individual truths, no regular or systematic study of nature, could ever proceed: and this is our conviction of a permanence and uniformity in the order of natural things: our belief that that which has happened in succession for days and years past, will, under the same circumstances, continue to happen for time to come: our persuasion that what so takes place in one instance, in one place, will and does take place, under the same conditions, in all other instances, and in all other places. We suppose, that is, that nature *is so constituted*, that there exists *some* principle of undeviating regularity in the connexion of qualities and properties, of causes and effects, even though we should fail in always tracing it.

This belief undoubtedly exists and operates in very different degrees in different minds. But a share of it, at least, is so universal, that some metaphysicians have been disposed to regard it as constituting one of the inherent principles of our nature*. Thus, the most ignorant person infers that the sun will rise to-morrow, and for succeeding days and years, because he has so regularly witnessed it before; and that a stone falls to the ground as constantly in America as in Europe.

In the limited form in which we commonly notice the operation of this sort of intuitive persuasion, it certainly does not amount to anything like a philosophical conviction of the uniformity of natural causes. It is, doubtless, restricted to certain isolated classes of facts, which in all their circumstances are constantly falling under the observation. In those limited instances, the individual, perhaps, relies on their recurrence from mere habit, which probably does not produce in his mind any general belief that other events beyond the limits of his observation are regulated by any like constant uniformity. Nor when the idea is suggested is he able to perceive the force of the inference from analogy; but, probably, imagines all things beyond the precise extent of his observation to be destitute of any determinate order, and the course of events in general, either under the dominion of arbitrary agency, or abandoned to chance or blind destiny.

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* Reid and Turgot consider it an ultimate principle of the human mind. Reid calls it specifically "The inductive principle."—*Inquiry into Human Mind*, ch. vi. § 24.

In proportion, however, as the mind is more cultivated, and man accustomed to reflect and reason on the objects continually presented to his senses, he is naturally, and even unconsciously, led to enlarge his persuasion of the general recurrence of natural phenomena, in the same order in which he has several times witnessed it. This persuasion easily extends itself to a great variety of particular instances, in which its correctness is soon verified by observation. The same habitual judgment thus gains strength by every hour's experience. The confidence with which the mind calculates, as it were, upon the permanence of a certain order in physical events, increases with rapidly-accumulating force; and the improvement of the faculties by study, and the enlargement of our stores of information from wider observation of physical facts, soon begins to induce the habit of extending our persuasion of the uniformity of natural causes, beyond the mere bounds of familiar phenomena, to those which are placed out of our immediate examination, but which we come naturally to imagine must be regulated by a like constancy.

Founded, then, on the natural constitution of the human mind, confirmed by daily experience, and verified by every advance in the accurate study both of mental and material phenomena, the belief in the existence of this uniformity becomes, in fact, the basis of all acquisition of knowledge, and enables us, without hesitation, to advance in our conclusions from the known to the unknown, from truths actually before us and within our reach, to those which may be hidden from us, or beyond the limits of sensible experience.

The belief in the uniformity and permanence of natural order, combined with, and perhaps dependent on, the tendency of the human mind to generalize its observations, unite to supply, as it were, at once the first impulse and primary elements of philosophic investigation. But it is further necessary that much care and skill be employed in the direction and use of them before they can produce any substantial results. We have then further to inquire how this is to be done; and we shall find that the models by which we must be guided, are to be found in the careful and extended study of already established natural relations.

## *Antecedent Probability in Induction.*

THE principles by which we are to be guided in advancing to sound generalizations of observed physical relations, must be those derived from the careful study and comparison of such generalizations previously confirmed in other corresponding instances, which will suggest probabilities antecedent to actual experience.

It will be to little purpose that we are persuaded of the existence of *some* uniformity in natural laws, unless we have this guide to assist in tracing what the principle of uniformity is in any particular case Without such assistance, we may go on collecting and observing a vast number of facts, and yet arrive at no conclusions, or only at such as are altogether empty and visionary.

As we have already remarked, that merely to affirm what we observe in common of a number of individuals, all of which are before us, is hardly worthy the name of an induction, so it is a violation of all just induction to infer a general property from too limited a number of instances. But what constitutes the *sufficient* number of instances must depend on the nature of the case, and the experience and power of judgment possessed by the inquirer.

And if we fall into the error of *too small* an induction, the usual cause of such error is rather that the induction is wanting in a just principle of probability in our first conjecture, or that we have proceeded on the supposition of a wrong sort of relation. It is this which has commonly much more to do with the justness of our conclusion than the mere *number* of instances collected. And, on the other hand, it often happens that a very few instances, or even almost a single instance, have been admitted without question as a sufficient verification: but this has depended entirely on the justness of the assumed relation.

We will illustrate these remarks by a few examples, both of successful and unsuccessful inductions, in different departments of science.

1. Newton, on passing a ray of light through a prism of glass, found it separated into coloured rays; and measuring the proportion in which it is thus spread out, or " dispersed," announced that proportion as the general law of prismatic dispersion.

Dr. Lucas repeated the experiment; but assigned a *much less proportion* as the law. Both parties positively maintained the correctness of their respective conclusions. But they had both argued on a faulty ground of induction: they had each taken for granted that their prisms ought to act equally on light. The fact was, they had used different sorts of glass, which vary considerably in dispersive power.

This is remarkable as one of the very few instances in which Newton failed in an induction; but such failures are instructive; for we learn to observe the reason of the error. It was manifestly from neglecting to consider, in this case, what *probability* there would be, *previous to trial*, that different sorts of glass should possess the same dispersive power.

On the other hand, Newton's capital result that " to the same ray ever belongs the same refrangibility," (the media being the same,) is a conclusion, indeed, of a most general nature, and which universal experience has amply confirmed, but it was founded on a very limited induction derived from prismatic experiments with, at most, three or four different media.

2. The early history of astronomy is full of

examples of the compatibility of accumulated observation with the want of satisfactory induction. The ancient astronomers were indefatigable in the diligence with which they amassed observations. But they constructed out of them no theory which could attain a real permanence. The system of Ptolemy sufficed to a certain extent to represent the observed motions of the planets. The advance in accuracy of observations, however, soon required corresponding improvements in the system; which was obliged to be modified to accord with them: but, at length, the immense complexity introduced by the cycles and epicycles which were necessary to account for the apparent motions, began to induce a persuasion that such complication could not be the real law of nature: juster principles were therefore to be sought. No astronomer ever laboured more sedulously in making and recording observations, than Tycho Brahe. But though persuaded of the insufficiency of the Ptolemaic hypothesis, he did not succeed in constructing a better: not from deficiency of facts, but from his strangely-erroneous assumption of a guiding theoretical principle.

Kepler worked upon Tycho's materials. The labour which he bestowed on calculation was absolutely incredible. But theory after theory was adopted and rejected, because he had not any other guide than random conjecture, and nothing but the accurate calculation of every detail could suffice to put those conjectures to the test. He had not lighted on any happy ground of *antecedent probability*. When, however, at last, he did seize upon the true law of nature, the numerical verification was perfect and decisive; and when thus established in the single instance of the planet Mars, it is extremely instructive to observe the rapidity and facility with which the inference was extended to the whole solar system.

When the laws of the motion of one planet were established, a single conjecture sufficed to point out, with the highest degree of probability, the laws of all the other planetary orbits: and a single calculation to verify it. The difference was, that there was now a ground of antecedent probability; a presumption of a guiding resemblance, which (though not strictly proved) was yet such as to leave no doubt that it had some foundation in nature.

### *Analogy the Ground of antecedent Probability.*

Thus, then, it is manifest, that to possess some reasonable ground of antecedent probability, as a guide to our conclusion, is absolutely essential to physical *induction*. And we cannot employ the term correctly in its higher sense, (as referring to anything above a mere collection of instances,) without meaning to include specially the notion of a fair presumption of some relation, in virtue of which we can argue from the known to the unknown; and infer that those cases which we do not see, are probably connected with those which we do. This constitutes one most essential characteristic of the inductive process; and without it, assuredly we can never advance to a substantial conclusion. We must always, then, consider the inductive method as referring, not merely to the accumulation of instances, but as *involving the idea of some presiding conception, some guiding principle, of presumed connexion and probable relation* between the facts on which we are reasoning.

In replying, then, to the inquiry, What constitutes the ground of antecedent probability, so essential to a good induction? it will be almost apparent, from the examples already cited, that the main ground is that afforded by the *comparison of one class of phenomena with another;* the perception of a *parallelism* in their respective conditions: the existence of an ANALOGY between them.

The success, then, with which induction may be carried on, depends on the just appreciation of such trains of analogy. This can only be attained by a habit of cautiously comparing our presumed generalization with already established laws. One induction must be the guide to another. We must seek to interpret nature in agreement with her own principles already displayed. Every real natural truth, we may be assured, will be in harmony with other parts of the great series and scale of natural truth. With this our hypothesis must be in accordance; to ascertain and verify such accordance is the aim of the true philosopher; and it is entirely on the justness with which it is preserved that the whole truth and success of induction depends.

Observation exhibits a certain law or relation among a particular class of facts. This suggests to the mind of the philosopher the probability of the same relation in another collection of facts, which leads to the belief that the cases are parallel. The relation being firmly established in one set of instances, he feels satisfied with even a slight indication of it in the other. The conviction of its probability once formed, a very few cases adduced serve to verify it. The experience of instances actually tried, leads to the expectation of analogous results in cases untried. But the essential point is the real *parallelism* of the cases. The hypothesis will be philosophical or not, according to the extent and justness of the comparison which has suggested it.

For example (1.) Experiment had shown that electricity in a high state of tension discharges itself with a flash and a report. Lightning and thunder exhibited an instance of a flash and a report. The atmosphere was known to be susceptible of electrical influence. All this had been ascertained, but no relation had been established between the cases. Other causes might possibly produce a flash and a report. But the analogy of electricity presented itself strongly to the philosophic mind of Franklin. By the string of a kite, as a conductor, he brought down the electricity of the clouds, which, on its arrival at the ground, was regularly discharged with sparks, and the analogy converted into an identity.

(2.) Every one had been accustomed for ages, before the time of Newton, to observe, that bodies fall to the ground as soon as support is withdrawn. They were equally familiar with the fact, that the moon circulates periodically about the earth. But no one ever perceived any relation or imaginable connexion between these two classes of facts. Nay, the peripatetics, maintaining that the heavenly motions were of an essentially different kind from the terrestrial, led men to the belief that these two cases could not possibly have any common relation.

The penetrating mind of Newton, however, instantly perceived a connexion between them. He considered that a body launched into space would continue to move off in a straight line, unless made to deviate from that path by the action of some other cause. Now the moon does not go off in a rectilinear path, but has her course continually *bent* from such direction into a curvilinear orbit round the earth; and the degree in which it is thus bent, or the amount of deviation from the straight course, is in fact, so much of a real *fall* towards the earth: the moon is actually falling like a stone: and the amount of its fall can be measured; since astronomical observation has given the size and form of its orbit, and the rapidity of its motion, that is, the amount of the deviation. Also the amount of the fall of a stone near the earth's surface is known. It becomes a matter of calculation to compare them. Newton made the comparison, and found the two effects precisely in the inverse proportion of the squares of the distances from the earth's centre. This was the precise proportion which would agree with the supposition of that law of central force, which, on abstract mechanical principles, ought to give rise to elliptic orbits, and to certain relations expressed by numerical laws between the magnitudes of those orbits and the motions in them. These were the very same as those numerical relations which had been found by Kepler long before to subsist in the planetary revolutions.

Thus the single circumstance of the *analogy* between the moon's motion and that of a stone falling to the ground, sufficed as a clue to the whole system of planetary motions, and the establishment of the principle of universal gravitation.

(3.) Physical philosophers had been long seeking to establish (what there was every reason to suspect) the existence of at least a close connexion, if not absolute identity, between electricity, galvanism, and magnetism. There were many points of resemblance in what was known of the nature of those agents; experiments had been multiplied, and many curious facts and results had been accumulated. But all this *collection of facts* had not afforded a real *induction*. And the reason was, that the inquirers had been guided either by no principle of analogy, or by such as was incorrect.

The most powerful electric forces had been resorted to; but no evolution of galvanic influence, no shock, however strong, would affect the magnetic needle. Experimenters were accustomed to witness the most intense electric action when the current was *broken*, or the accumulated power discharged; here, therefore, they expected to find the greatest effect of a magnetic kind.

But these modes of action were of a kind offering no analogy to those really concerned in the cases in question. This, however, was not perceived, till Œrsted discovered the true point of connexion of electricity and magnetism. He succeeded, by a very slight change in the arrangement from that with which his predecessors had been so long and so fruitlessly working. By using an *unbroken* galvanic circuit, he instantly found an influence on the magnetic needle: not by violent concentration of forces but by a peculiar diffusion of them. And the whole system of action by transverse currents was almost immediately developed and followed out into all its correlative trains of consequences.

(4.) Newton published his *Principia* before any instance of the periodical return of a comet had been established, or even imagined. Yet, on comparing the masses of these bodies and their distances with those of the planets, he caught an analogy, and did not hesitate to speak positively of their describing orbits about the sun, and to recommend to future astronomers to verify their returns by comparison of observations*. It is superfluous to notice how completely this idea has been borne out by subsequent discoveries.

(5.) In the extension of the law of gravitation from the fall of a stone on the earth to the motions of the most distant planet or the most erratic comet, we have a remarkable instance where a conclusion is made from effects which we observe near us, to those of the same kind which are produced in the remotest regions of *space*. Let us compare this with a parallel case in *time*. We observe the daily formation of rounded pebbles by the action of the waves on fragments of rock on the sea-shore; and we find the incessant continuance of that action for a long time give rise to accumulated beds of shingle.

Now, over large tracts of land, at considerable elevations above the sea, we find immense beds of pebbles presenting precisely the same appearance of rolled and rounded fragments, as those we now observe in the progress of formation in the sea. It is, then, by the same process of reasoning which connects the gravitation of a stone with that of the moon, or the remotest planet or comet, that we connect the formation of beds of pebbles at the present day with that of similar beds in ages of remote antiquity, when the present dry land formed the bottom of the ocean; or, rather, was gradually emerging from it, through such a long succession of ages as would alone suffice for the production of the immense beds of rolled gravel which we find deposited over a large part of the surface of the globe.

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* See *Principia*, lib. iii. prop. 39, corr. 3, and prop. 41 at the end.

### *Force of Physical Analogies.*

PHILOSOPHICAL induction, then, proceeds mainly by seizing upon analogies between known orders of facts, known relations of cause and effect, and cases where the existence of such relations is unknown, but where the circumstances render it probable that they also subsist. Such circumstances, perhaps quite casual and unimportant in the eyes of the ordinary observer, suggest in an instant, to the practised mind of the philosophical inquirer, a train of relations in which the analogy is maintained. He proceeds to verify his idea: a single experimental instance often suffices to confirm it; and at most, a very few repetitions and variations in the circumstances and conditions, satisfy him that his analogy is correct, and the uniformity of the law by which physical action is determined becomes established.

In fact, so essential to induction is the dependence on analogy, that in the very use of the terms, " observation," " experience," and the like, by many writers, to describe the grounds of our belief in physical events, it is evident that they mean to include *essentially* the reference to *analogy*, and not barely to facts actually witnessed. Unless this be the case, indeed, their meaning would, in some cases, be involved in absurdity and contradiction.

Thus, then, the most important part of the process of induction consists in seizing upon the probable connecting relation by which we can extend what we observe in a few cases to all. In proportion to the justness of this assumption, and the correctness of our judgment in tracing and adopting it, will the induction be successful. The methods by which a facility in discovering such relations, and a readiness in forming such judgment, may be attained and improved, are precisely the objects principally to be kept in view by the philosophical student who would prepare himself for the work of interpreting the phenomena of the natural world. The analogies to be pursued must be those suggested from already-ascertained laws and relations. This, in proportion to the extent of the inquirer's previous knowledge of such relations subsisting in other parts of nature, will be his means of guidance to a correct train of inference in that before him.

And he who has, even to a limited extent, been led to observe the connexion between one class of physical truths and another, will almost unconsciously acquire a tendency to perceive such relations among the facts continually presented to him. The truth of the remark to which we have been thus led is amply confirmed by the history of philosophical discovery.

In point of fact, discoveries, commonly termed inductive, have very seldom been really attained by the mere process of amassing collections of individual facts. It has been almost invariably the case that hypothesis has preceded observation; and that the discoverer has in truth only verified, by an appeal to experiment, the general theory which he had already imagined. The happy selection of such hypotheses is that which characterizes, and in fact constitutes, philosophical genius. And a just appreciation of the use of such imaginary provisional assumptions, eminently distinguishes the rational inquirer from the speculative visionary. The true philosopher neither discards hypothesis on the one hand, nor yields himself up to it on the other; but rates it at its proper value, and turns it to its legitimate use. He is always ready to reject an assumed theory the moment he finds it unsupported by fact: but if it be once duly substantiated, to adopt it, and be prepared to follow it out into all its legitimate consequences, however at variance with received notions—however contrary to established prejudices—however opposed to the prepossessions, the bigotry, the cherished delusions of mankind.

And the more extensive his acquaintance with nature, the more firmly is he impressed with the belief that some such relation must subsist in all cases, however limited a portion of it he may be able actually to trace. And it is by the exercise of an unusual skill in this way, that the greatest philosophers have been able to achieve their triumphs in the reduction of facts under the dominion of general laws.

But important as these natural analogies are to the philosopher, they are yet of a nature which renders it difficult to make them generally appreciated: and, unless by actual and attentive study of physical science, it is difficult to convey an adequate conception of the irresistible claim to acceptance with which they present themselves to the mind of a person even moderately versed in such inquiries. Yet they are, in fact, no more than extensions of the very same elements of thought, which seem implanted in our nature; by which all our acquaintance with sensible objects is, in the first instance, acquired; and by which we are continually and unconsciously storing our minds with that knowledge which is so necessary for all the purposes of our existence;—those natural persuasions upon which all uniform convictions, and all consistent conduct, is based;—and without which life would be a continued state of infancy.

### *Mathematical Laws.*

It is not, perhaps, until we come to contemplate natural phenomena, exhibited in the form of numerical results, and find those data reducible to mathematical laws, that we fully appreciate the reality and exactness of that uniformity by which all nature works. The coincidence with such laws, is that which, above all others, impresses us with the conviction of invariable order and uniformity pervading the material universe.

We find this, in the first instance, in the reduction of vast collections of observed numerical results, under simple mathematical formulas. But the more extended application of mathematical analysis powerfully augments the impression produced on our minds by the conspiring inductions, and corroborating generalizations, of purely physical investigations. From some one very simple, remote, and abstract datum, obtained from elementary physical facts, we often proceed by purely mathematical reasoning, perhaps through a long and intricate deduction, which at length brings us to the conclusion, that, under certain conditions, a particular kind of action ought to take place; and even the precise amount of its effects ought to be such as are given by a certain analytical expression. The results of observation exactly accord with these deductions; and even the minutest variations in the effects are exactly represented by calculation from the formula of theory.

We have occasionally singular exemplifications of the existence of recondite principles of analogy, in the coincidence of phenomena with the symbolical indications of mathematical analysis. A mathematical formula is found, which expresses the law of a certain class of phenomena. The analytical language of symbols admits, perhaps, of certain changes, or embraces certain cases, not at all contemplated in the first numerical establishment of the law; but dependent purely upon abstract algebraical rules and transformations. These symbolical changes shall be found to have physical cases exactly corresponding to them.

In the higher departments of physical optics, this has been most surprisingly exemplified. We need only cite the marvellous prediction of the conversion of plane into circular polarization of light, by two internal reflections in glass, made and verified by M. Fresnel, entirely upon the strength of certain mechanical and mathematical analogies. "A conclusion," (as Professor Forbes justly remarks,) "which no general acuteness could have foreseen; and which was founded on the mere analogy of certain interpretations of imaginary expressions. The mere reasoner about phenomena could never have arrived at the result,—the mere mathematician would have repudiated a deduction founded upon analogy alone*."

### *Induction in Natural History.*

THERE is, perhaps, no branch of science in which the use of analogy as subservient to the process of induction, is more conspicuously and instructively displayed than in comparative anatomy and physiology. Thus Cuvier† emphatically remarks that a naturalist, in his researches, happening to find only a hoof, directly and certainly infers that it was associated with grinding teeth, having flat surfaces, a long alimentary canal, a large stomach, or several; and many other similar characteristics. Yet such conclusions are of a nature strictly inductive. Again, the system of the organs of motion is universally found to be so adjusted, that a variation in the form of one bone is invariably accompanied by variations more or less in all the others. Thus in any new case which may present itself, from a single bone the skilful naturalist will often be able to infer the form of the whole skeleton. On what does the legitimacy of such inferences depend: on what ground of confidence can such reasoning be pursued, but on the assurance of those unfailing principles of analogy which unquestionably pervade the entire range of organized nature, and thus supply the main ground of stability to these inductive conclusions.

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* On *Polarization of Heat, Edinb. Trans.* vol. xiii.

† *Leçons d'Anatomie Comparée.*

That whenever a new plant or animal is discovered, we should never come to any thing anomalous or at variance with systematic order; but that, even in those instances which are apparently the most unlike any previously known, the skilful naturalist should always succeed in assigning to the production in question its precise place in the scale and order of organized beings, and that all fresh discoveries should but fill up blanks in the scheme, is the strongest proof of the existence of some principle of the most recondite uniformity throughout all the modifications of organized structures. In fact, to elucidate and develope such principles of uniformity and analogy, has been the very object of the labours of the most eminent naturalists; and the best proof of the actual prevalence and admirable unity of those principles is found in the increasing simplicity to which the arrangement of natural classes has been reduced.

Thus the researches of Cuvier reduce the laws of animated existence to only four principal "types," or general schemes of organization, founded on the presence or absence of vertebræ, after which (as he observes,) all animals appear to have been modelled; and of which the subordinate divisions are only comparatively slight modifications, founded on the developement or addition of certain parts, which produce no essential change in the original plan: viz., 1. The Vertebrata, with bony skeletons; 2. The Mollusca, soft, with shells; 3. The Articulata, jointed or ringed; 4. The Radiata, or zoophytes.

Within the limits of each of these four classes, Cuvier traced a precise set of analogies among all their various subdivisions; so that for every member or organ in one species, there was to be found invariably some member or organ in all the others, holding exactly the same place in relation to the general structure and nature of the animal; and thus between the two extreme instances which fall under any one class, though there might exist the utmost possible *dissimilarity* in every respect, yet there was found the closest *analogy;* in every creature of that class could be pointed out by the skilful comparative anatomist, an exact *correspondence* in the nature and office of every part relative to the nature of the animal, though bearing not the slightest *resemblance.* When, however, these great classes themselves were compared together, such analogy seemed to be no further traceable. Each class seemed to include a distinct plan of organization, possessing an unity within itself, but not apparently related to that of the other classes. But these views have been pushed further; another school of physiologists, among whom Geoffrey St. Hilaire stands most conspicuous, have contended that even these breaks between the four classes may be filled up, and new principles of analogy developed and traced out, by which these apparently distinct plans of organization may be shown to have a common system of relation; and thus throughout all classes, a principle of still more recondite connexion be perceived.

This principle carried out to its full extent, has been named the " unity of plan or of composition," or the " theory of analogues," and the particular views of structure by which it is upheld, have been designated as the " equilibrization of organs," or other similar names. While, however, the main principle of the reality of some such system of primitive types is universally recognised by naturalists, yet considerable difference of opinion prevails as to the details of its application, and as to the extent to which it may be followed out. And the question which has thus arisen has occasioned considerable controversy between the partisans of the two rival schools; principally, perhaps, in consequence of its being mixed up with other topics, with which it has at least no *necessary* connexion; and to which we shall recur in another place. With reference to our present purpose, it will be sufficient to remark simply, that the question between these theories, or rather the question whether the *extension* given to the great principle of uniformity by the second of them, is *true*, must be decided merely by physiological evidence: it is purely a question of *fact*, and must be investigated by careful examination and enlightened comparison of facts and analogies, without any reference to the speculative topics with which it has been mixed up; a distinction which, however plain, seems to have been too much overlooked.

But however this question may be determined, our chief consideration should be to observe, either way, how beautiful an extension of the great principles of natural order and harmonious arrangement is opened to our view. And it is the increasing assurance of this which is continually strengthening the foundation of all our inductive reasonings; of all consistent and profitable search into the laws of the material creation.

### *Induction in Geology.*

We meet with perhaps the most remarkable instances of the application of the inductive conclusions of comparative anatomy in deciphering the history of *fossil* remains. The whole subject is, in in fact, only a continued series of such inferences. The entire structure, nature, and habits of animals once inhabiting the earth, are deduced from the occurrence of a few bones, or perhaps a single tooth, or scale, embedded and mineralized in some now solid rock; and yet with the full force of inductive evidence.

It is upon the study of fossil organic remains that the conclusions of geology mainly depend. And in a more general point of view, the researches of this science afford some of the best examples of the vast range of inference to which strict induction may be extended; of conclusions apparently the most remote, the most inconceivable, the most startling; yet all evinced by the same rigidly inductive process by which the most palpable laws of mechanical action are established. The observer finds at various elevations above the sea, beds of shells, and remains of marine animals, buried beneath the soil, or imbedded in the solid rock; he comes most legitimately to the conclusion that these relics were buried when the beds of soil or rock were in the process of formation, in a soft state; when they formed, in fact, the bottom of the waters in which, or on the margin, the animals lived and died; and that these beds have since been laid dry, and elevated into their present position.

Again he finds one sort of earth or rock extending over a considerable tract, from beneath which, at the edge of that tract, another of a widely different species comes up, and appears at the surface, showing its relative position wherever a section may be made, and proved to exist under the other wherever a well is sunk to a sufficient depth. He infers that the lower was deposited before the upper. And this simply on the same evidence as that on which we believe that the roof of a house was built at a later time than the foundation, though we did not witness it.

Again, the geologist calls in the aid of the naturalist; in the upper strata, the fossil remains are found nearly agreeing with existing species; in the lower, some perhaps the same, but many totally different; belonging, that is, to species not now known to exist. He carries on the research, and in another still lower stratum, of a different kind of material, finds fewer, or none, of existing species, and many, or all, extinct species. Nay, whole genera, and even orders of animals, successively disappearing, and new ones taking their place, as he comes into deeper deposits of other kinds of rock. His inference, that in successive periods, different classes of beings inhabited the earth; that their races successively became extinct; that new species were successively produced and destroyed in like manner; until the present order of animated beings was thus gradually introduced, is a conclusion simply dependent on the very same grounds of induction, guided by analogy, as those by which any of the most certain physical truths are established.

The appearances, in some instances, of the imbedding of organic remains may be those of a sudden destruction; in others, of a gradual deposition and covering up of the remains of many generations of animals, dying in the course of nature, and in various stages of growth. The beds containing these deposits are superposed, to a vast number; and often alternate with others in which no organic remains occur. It is from the consideration of all these and the like circumstances, on every ground of analogy, and by the most strict induction, that the geologist arrives at his conclusion, that to bring about these results involved a series of events which required a long succession of ages for their accomplishment.

Again, when it is remarked that this applies not merely to the destruction of a vast multitude of individual creatures, but to the disappearance of entire *species*, classes, and orders; and that this disappearance is every where gradual, the *proportion* of the numbers of one species discovered co-existing with another, being found to go through a *regular* course of *diminution* as we recede to older formations; the same inference is further confirmed and extended.

Again, the upheaving and laying dry from the domains of the ocean of any large portion of land, especially where it is destitute of all marks of forcible disruption, or the apparent effects of sudden violence, must, by rational comparison, be inferred to have taken place by almost imperceptible degrees. When we combine these considerations with that of the *number* of superposed beds which observation of the varieties of mineral character as well as of characteristic fossils discloses to us, and of the limited local extent of each, we are necessitated, upon the lowest possible computation consistent with inductive inference, to assign an almost incalculable series of ages to each one of those successive deposits, and, strictly in the spirit of inductive analogy, to carry our inferences back to epochs in the depths of primæval antiquity in the history of our planet, during which long-continued dynasties of animal and vegetable life maintained their sway under circumstances more or less different from any which prevail now, yet in all cases evincing the unbroken continuance of the same analogies in the structure and instincts of the animals, and in the regular operation of the same physical laws in conformity with which the changes were brought about.

Instances occur where a mountain mass bears evident marks of having been forced up from beneath, while, resting on its base, the strata of the plain (of a different kind of rock,) are observed perfectly horizontal and undisturbed. No one who is disposed to consider the subject in a rational way can doubt that these undisturbed strata were deposited *after* the upheaving of the mountains.

Again, in certain other mountains, a different set of appearances present themselves; patches of superficial strata, the same as those of the valley, are found resting on the elevated parts; and the strata of the valley also disturbed from their horizontal position, tilted up and inclined against the sides of the mountain. No reasonable doubt can be entertained that these were deposited *before* the upheaving of the mountains; and were carried up by the same action which elevated them.

### *Combinations of Inductions.*

THE force of inductive conclusions, guided by wide analogies, is often immensely increased by the combination, and converging to a common point, of several different trains of investigation, setting out from entirely distinct and remote origins; yet all ultimately, and often very unexpectedly, brought to bear on the same conclusion.

Thus Dugald Stewart* had acutely observed, "The uniformity of animal instinct presupposes a corresponding regularity in the physical laws of the universe, insomuch that if the established order of the material world were to be essentially disturbed, (the instincts of the brutes remaining the same,) all their various tribes would inevitably perish." Mr.

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* *Philosophy of Mind*, ii. 230.

Lyell extends this inference in a remarkable manner to the condition of the globe at a remote period.

"Any naturalist," (he observes,) "will be convinced, on slight reflection, of the justice of this remark. He will also admit that the *same species* have always retained the same instincts, and therefore that all the strata wherein any of *their* remains occur must have been formed when the phenomena of inanimate matter were the same as they are in the actual condition of the earth. The same conclusion must also be extended to the extinct animals with which the remains of these living species are associated; and by these means we are enabled to establish the permanence of the existing physical laws throughout the whole period when the tertiary deposits were formed *."

Geology, indeed, is full of striking examples of such *combined* inductions. It calls to its aid the separate resources of many distinct branches of physical inquiry, and from their *united* testimony, collects the materials of its conclusions.

Thus the naturalist traces not only the invariable characteristics of species, but also the peculiarities which mark the adaptation of species to climate; he finds the characteristics belonging to a warm climate in the fossil remains which the geologist submits to his examination.

The astronomer demonstrates the effects of the change which is taking place with insensible slow-

* *Geology*, p. 161, 1st ed.

ness in the form of the earth's orbit, to be that of a diminution (however slight,) in the mean temperature arising from the supply of heat from the sun.

While the physical philosopher argues on the theory of central heat for the primitive high temperature of the globe, the meteorological geographer finds in the peculiar distribution of land and water on the earth's surface, a powerful agent in modifying climate. The geologist infers from unequivocal proofs that such changes in the distribution of sea and land have actually occurred. And by successive *local* operations, extensive and ultimately perhaps universal alterations have been accomplished in the relative position of the oceans and continents. Such effects have gone on in former periods by depositions and inroads, by elevations and subsidences, as they are still continuing to do.

How vastly does the mutually-conspiring testimony of these very different trains of research tend to increase the force of the inductive inference that the fossil animals and plants alluded to existed at incalculably remote periods, when the present land was the bed of the ocean, and when the surface of our planet enjoyed a higher temperature than at present, and that from the changes of temperature and local conditions, causes were brought into action, which occasioned the extinction of some species, and were favourable to the introduction of others of new kinds.

### *Caution in assuming Analogies.*

BUT even if in any case a particular analogy should fail; if the clue should break; if some unexpected and anomalous fact should throw into confusion our previously imagined arrangement, still so powerful is the confidence inspired by what we do satisfactorily know of the permanence of natural order, that we can never really distrust the stability of such a foundation for our reasonings.

If it be true that *this particular* analogy is overthrown, the only fair conclusion is, that, in this case, our conceptions were too hasty, not that the order of nature is violated. The conviction that *some* real analogy subsists is in no degree weakened, because we may have failed as yet to light upon it. The certainty that there is a right path is not diminished because we may have taken a wrong one. The only effect of such an occurrence on a truly philosophic mind, will be the excitement of a still more diligent search after those characteristic circumstances which may indicate the true point of comparison.

We will illustrate this remark by a few examples:

(1.) The earth moves from west to east; all the primary planets revolve in the same direction, including Uranus; the same is true of our moon, and of those of Jupiter and Saturn, and the ring of the latter planet. On the discovery of the satellites of Uranus, would it not then have appeared fair to expect that they would move in the same direction?

Yet, in fact, they revolve in the opposite direction. But why should we thus extend the inference? Perhaps we feel persuaded that there must be something common in the nature of all the planetary motions; nor can it be denied that such an idea is very natural; the only fault is, that the hypothesis is not comprehensive enough. Let us look at one other circumstance; the earth, Jupiter and Saturn have their satellites' orbits very nearly in the plane of the ecliptic. Suppose we were to affirm that those satellites, whose orbits are nearly in the plane of the ecliptic, have their motions from west to east, then our proposition would be completely verified; for the orbits of the satellites of Uranus differ from all the others in being almost *perpendicular* to the plane of the ecliptic. We should, therefore, now have a very fair ground of inductive inference in supposing some connexion between the inclination of the orbits and the direction of the motion. Again, there *may* possibly exist a relation of another kind; the peculiarities of this planet may form a connecting link, as it were, with other laws prevailing in a further series of planets beyond it; or if it be the last, in other systems beyond ours. From such instances as this we learn no disparagement to the uniformity of nature, though much caution in forming our conjectures as to its character; no distrust of the existence of order and arrangement, but only the necessity for a just ground of probability in tracing them.

(2.) We may adduce as another instance, the case which has been fully stated, and turned to such important purposes of argument, by Mr. Babbage*, derived from his own calculating engine. Considered here *merely with reference to our present subject*, it is perhaps one of the most remarkable illustrations which could be selected of the necessity of caution, and the most extended range of induction, before we can satisfactorily establish the absolute generality of any conclusion.

The case is briefly this: the machine being set in a particular manner, will go on producing the series of natural numbers, 1, 2, 3, 4, &c., and this may be carried to several thousands; from *induction* the observer might then infer that it would go on for as many thousands more. It in fact continues up to 100,000,000; the same induction would seem to render it next to certain that the series would be continued; it produces 100,000,001; but the next term, instead of being 100,000,002, will, in fact, be 100,010,002. Here we might infer analogy is entirely broken, and there is an end of all confidence in induction. But when the calculation is continued it is found that now a new but still perfectly regular law of a different kind begins to prevail. Again, at a further extremely remote period, this ceases, and another law commences; and these all connected by another rule; and so on without limit. The fault then was simply that our first induction was too limited; not that there was a failure in the real law.

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* *Ninth Bridgwater Treatise*, p. 36.

(3.) To take another example:—Newton made observations on the rate at which hot bodies cool, and found a simple law to express how the rapidity changes as the time elapses. This was deduced by induction: but it did not extend beyond a certain range of temperature. Later observers went to higher temperatures, and found the law fail. Was this then any disparagement to the real existence of *some* analogy, or *some* determinate law? This question would receive but one answer from all who knew anything of physical reasoning; and that answer was speedily confirmed by the researches of Dulong and Petit, who established a more comprehensive law, applying accurately to all cases; and which, for lower temperatures, resolved itself into the simpler law before found by Newton.

(4.) Philosophers have been for the last century sedulously engaged in collecting observations on the direction, intensity, and variation of terrestrial magnetism. Various attempts have been made to frame some sort of theory to represent its laws, but none hitherto with more than very partial success. But are we, therefore, to infer that there really exists no fixed law, or regular cause of the phenomena? It is only a guiding principle of probability deduced by comparison with some corresponding class of effects, which is wanting. Now the later discoveries of electro-magnetism suggest the analogy of a series of currents, and the idea of the globe as a vast electro-magnetic, or rather, perhaps, thermo-magnetic, combination: which, again, is rendered extremely probable by the known metallic nature of its materials. Some theory of this kind is most likely to supply the clue which will ultimately conduct us to a systematic view of this curious subject.

(5.) To take one more instance: The extraordinary parallelism which subsists between the phenomena of light and sound has led to a theory for explaining the most perplexed and intricate results disclosed by optical experiments.

Two pipes, pitched a little out of unison, sounded together, produce, not a double sound, but beats, that is, alternations of sound and silence. Two streams of light, almost coinciding in direction, produce, not a double light, but stripes, that is, alternations of light and darkness.

Several distinguished philosophers had each proposed theories, which well explained *some portion* of the phenomena of physical optics. But it was not until the above analogy occurred to Dr. Young, that a general explanation was supplied, which he named the principle of interference. This doctrine, however, is only a branch and consequence of the more comprehensive theory of undulations, which, in the hands of Fresnel, Cauchy, and others, has now afforded the perfect explanation of nearly all the most complicated phenomena of light, which observation has presented.

There are, however, some phenomena which this theory does not perfectly account for. The absorption of certain of the primary rays, and not of others, by different transparent media, presents results of the most varied and apparently irregular kind. For a long time they were considered to defy all attempts at theoretical explanation. But even here a remarkably instructive instance of the value of philosophical analogy occurred. Sir J. Herschel brought arguments from such analogies alone, to bear on the question with the greatest effect; and by a striking reference to a parallel case in the doctrine of sound, (which is perfectly explained by the theory of vibrations of the air as the cause of sound,) he *demonstrated, not* that the undulatory theory explains the phenomena of absorption of light, but that those phenomena, however unexplained, constitute no valid objection against its truth. The paper*, independently of its physical interest, is well worthy of being studied by the intellectual philosopher. And, further, a very recent investigation by Baron Von Wrede, has at least shown that the analytical prosecution of the idea thus suggested gives a mathematical explanation of the *general* fact: though its precise laws have not yet been determined so as to afford data for any application of the test of numerical calculation†.

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* *London and Edinburgh Journal of Science*, Dec. 1833.

† Taylor's *Foreign Scientific Memoirs*, parts iii. and iv.

### *Rejection of Principles foreign to Analogy.*

Of this, however, we may be most certainly convinced, that although, in any particular instance, we may fail in tracing out the real connexion of natural causes by this or that assumed analogy, which may in itself appear very conformable to probability, we shall assuredly never succeed by adopting any hypothesis which is independent of natural analogies, or foreign to them; we shall never arrive at any satisfactory explanation of nature, or any real philosophical truth, by having recourse to other principles ALIEN from those of *induction*. Nature must always be her own interpreter.

If we adopt hypotheses for example built upon *metaphysical* or *moral* considerations, we may be certain they will never conduct us to *physical* truth. Whatever may be their merits in themselves, and when directed to their proper purposes, they are totally misapplied in physical subjects: or rather, it must be from an entire misapprehension of the nature and objects of physical researches, that we shall ever be induced to connect them with such speculations.

### *Example: Theories of Cosmogony.*

In the earlier stages of geological science it was in a singular degree abandoned, as it were, to groundless hypotheses, often framed in utter defiance of all principles of analogy. But a more just and rational method has since begun to prevail; a method which (whatever difference of opinion may exist on some points of detail) must be recognised by all philosophic inquirers, as sound in its *principle*, viz., that of reasoning cautiously on the facts, *from the known to the unknown, by the guidance of rationally adopted analogies.* Speculations, which, in accordance with some formerly received views, once passed current for sound geology, were really such as altogether to discredit the uniformity of natural causes. But the more closely we adhere to sober and legitimate induction, the more will every discovery indicate the unbroken uniformity of plan, which has prevailed through the immeasurable periods of past stages of organized life. "If," says Mr. Lyell, "instead of inverting the natural order of inquiry, we cautiously proceed in our investigations, from the known to the unknown, and begin by studying the most modern periods of the earth's history, attempting afterwards to decipher the monuments of more ancient changes, we can never so far lose sight of analogy as to suspect that we have arrived at a new system, governed by different physical laws*."

The necessity of proceeding on such principles, to the utter rejection of all gratuitous suppositions, or cherished prejudices, is now becoming more generally acknowledged: the grand conclusions deduced are independent of all disputed theoretical questions; and are now admitted by rational geologists of all schools.

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* *Geology*, vol. i. p. 160.

The evidence of facts is undeniable as to all the main features of the process by which the surface of our planet was gradually brought into its present condition. The business of inductive geology is to compare the monuments of early changes in the earth's surface with those now in the course of progress: and that this is a sound principle to proceed upon is assured to us by the circumstance, that in the succession of these changes we meet with no interruption: we witness such effects locally and gradually going on at the present day: we trace by diligent observation the evidences of their having gone on in the same *manner* (whether or not upon a larger *scale*) in ages earlier than the records of history: in the deposits characterized by the remains of organized beings of the same species as those now inhabiting the earth: in the earlier beds, where existing species are mixed with extinct: until we arrive in succession at those containing none of the former and all of the latter class. The continuance of the same set of appearances is *unbroken* from the present time, through those comparatively recent deposits, up to those of older formation. And though the authority of Cuvier was once appealed to as having inferred from the alternations in the tertiary formations of the Paris basin, that here there were interruptions of order, from causes not apparent, and that " the thread of induction was broken," yet the later researches of Lyell and others have explained those apparent breaches of continuity in the series, and the investigation of those tertiary beds, in all their varieties of organic characteristics, has now become the principal source of evidence by which geologists have fully established the unbroken series, the uninterrupted continuity of these formations, in relation with the existing organized products of the neighbouring seas, and the operations of now existing laws. And whatever may have been the magnitude of some of the operations in remote epochs, yet we find no deviation from the continuance of action of the same kind; no real suspension of regular laws, no simultaneous universal destruction and reconstruction of the globe; but through the whole range of those periods of which we can decipher the monuments, we have continued evidence of the same system of gradual changes by which the existing state of things was, by slow degrees, evolved out of previous orders of existence.

Such must be the *general* view of the matter (whatever difference may subsist on minor points,) which will be upheld by the inductive geologist in contradistinction to the dogmatical assertions of the cosmogonist. The chimerical, yet favourite notion, of a sudden total change, of a catastrophe by which one world was suddenly reduced to chaos, and another as suddenly called forth out of its ruins, during any of the periods the records of which we read in their existing organic remains, is not only wholly inadmissible, inasmuch as it must be derived altogether from considerations alien to those of physical analogy, but is absolutely contradicted by all inductive testimony.

We find no period since the very commencement of all those depositions which contain organic remains, at which *some* portion of the earth's surface was not abundantly peopled with an animal and vegetable creation, more or less different indeed from that now existing, but in all respects preserving an exact uniformity of plan and design, and precisely and admirably fitted for the kind of existence which accorded with the then condition of the globe; but destined gradually to disappear as those conditions were changed, and as other and varied forms of existence were in succession introduced. The total absence of all marks of any universal sudden overwhelming convulsion, supplies positive proof that nothing of the kind took place within any of those periods, the monuments of whose duration we find in the accumulated remains of successive formations; especially during any of the later epochs, and least of all subsequently to the latest tertiary deposits, that is, within those times which can alone possibly accord with the received chronology of the human species, and with the æra of those changes which brought the globe into a state suited to the residence of man.

The adoption, then, of any such theory on which to raise geological speculations must, on every ground, be utterly at variance with sound inductive principles.

### *Inductive Character of Geology.*

In the illustrations above given, I have enlarged on those selected from geology in particular, with reference to objections often brought against that branch, as if it were of a less strictly inductive character than others. This, I conceive, is an idea which must totally vanish before the slightest real examination of the nature of the reasoning employed by any sound geologists; though it may be freely admitted that most extravagant speculations have occasionally been obtruded on the world under the name of geological theories. Yet these, the moment they are critically examined, are found to be defective, not merely in their details, but in the assumption of their first principles, and the very method by which the investigations are conducted. Among sound and rational geologists, whatever difference may exist as to certain theoretical views, none whatever can subsist as to the sole recognition of strict inductive reasoning, and the utter rejection of all other authority, on which to rest their conclusions.

Some persons have indeed been urgent in denying to geology the claim to be ranked among the *exact* sciences, and have appealed to the authority of great names in support of their assertion, having all the while a very confused idea of the meaning of an "*exact*" science; and imagining that when it has been refused this title, it was meant to withhold from it the character of substantial physical truth and inductive certainty. Whereas it is evident to those who are but moderately conversant with the current scientific language of the day, that the phrase "exact science" has been used solely as designating those branches of physical inquiry which could be brought under the dominion of *mathematical* laws, and whose results could be exhibited in a numerical form, and compared with theory by arithmetical computation. In this sense undoubtedly geology has not yet become one of the "*exact*" sciences; though from the nature of some recent researches* on the effects of mechanical forces such as may be supposed to have acted in the elevations of the various parts of the earth's crust, it would seem to be fast approaching to the condition even of this class of investigations. But, at any rate, this is quite independent of its claim to be received as among the most incontrovertible of those systems of inductive truth which have not as yet been of a nature to receive the aid of mathematical demonstration.

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* See the papers of Mr. Hopkins in the *Cambridge Transactions.*

## *Objections to Geology.*

I HAVE felt it desirable to dwell the more particularly on the *strictly inductive* character of *geology*, not only on general grounds, but more especially because much pains and some ingenuity have been employed to disparage and even deny the evidence of this science*. To some such objections we have already referred; and the rest are not more rational or more consistent. When refuted on other grounds, their upholders take refuge in the convenient maxim, that after all, geology is but in its infancy, and as many theories once adopted have now been rejected, so those now in vogue may be in their turn exploded: or again, they contend that the utmost extent of our researches has not penetrated beyond the mere crust of the earth,—how then can we pretend to draw such general conclusions?

If the science be in its infancy, we can only say that it has displayed such vigour as already to have grappled with and overcome the most formidable attacks. False theories have indeed been exploded; but the order of advance has been regular and systematic; the early cosmogonical speculations have indeed been discarded, for the simple reason that they were not founded on induction, but on some foreign principle or authority, and therefore had no substantial or enduring consistency. A remnant of the same spirit, however, continued to linger about the schools of geology, and displayed itself in later times in the diluvial hypothesis, and others of the same nature. These, in their various modifications, have since given way, and for the very same reason, because their foundation was defective; it was based on *some other authority* than that of simple induction. So the belief in vast and sudden revolutions in the state of the entire globe has been discarded; the inductive principle is extending its triumphs, and if all the phenomena presented by the observed state of the earth's surface have not been actually explained by the action of known causes, yet many have been which were before not perceived to be capable of such explanation; and it has become generally admitted that this is the only sound method to be pursued in the endeavour to throw any real light upon them.

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* See Note B.

In this way, and in this steady course of advance from the hypothetical to the matter-of-fact, may geological theories come to be successively modified, but in no other. Those who make this a topic of objection must, therefore, prepare themselves to expect, in the changes they may anticipate, nothing favourable to any preconceived hypotheses, but every thing tending still more and more to take a direction entirely opposed to those favourite schemes of cosmogony which have usually prompted these and the like objections.

And if, as the objectors urge, we have penetrated as yet only a thin film, as it were, of the mere outward crust of the earth, how completely does the obvious inference recoil on themselves! If by going only to this trifling extent, we have succeeded in obtaining such a mass of evidence, and substantiating such vast and overpowering conclusions, what may not result when our inquiries shall be able to penetrate still deeper?

The introduction of imaginary systems of cosmogony into geology, is but an exemplification of the same fallacious principles of speculation, by which every branch of physical inquiry has, in its turn, been impeded and perverted. It was in the same spirit that Kepler believed the globe to be a living animal: that Tycho Brahe feigned the sun with his attendant planets to revolve round the earth: and that the equilibrium of the mercury in the barometer, was ascribed by Linus to a suspension by invisible threads.

### *False Philosophy from neglect of Analogy.*

The same want of inductive principles, the same spirit of gratuitous theorizing, which prevailed in the disputations of the schoolmen, characterized in no less degree the speculations of Descartes and his followers, which in a later age took their place. The main error which pervaded the whole system of that eminent philosopher, was the adoption of a *metaphysical basis*, on which to rear the edifice of *physical* truth. Or, in a word, the introduction of some other guiding authority than simply that of natural analogies, suggested and supported by the habitual recurrence to the sole test and standard of experimental evidence.

From the influence of the same cause, even in comparatively modern times, it required a long struggle to divest chemistry of that chimerical theory of combustion, whose advocates imagined "phlogiston,"—a sort of metaphysical something, they knew not what, which conferred on bodies the property of being combustible, and was abstracted during the process.

In this recurrence to principles alien from those of induction, we find the radical defect common to the ancient as well as the modern scholastic theories. This was the fundamental mistake which vitiated alike the system of the peripatetics and the Hutchinsonians; which upheld the crystalline spheres and the ætherial vortices—the starry influences and the diluvial cataclysms; the cosmogonists' chaos and the philosophers' stone.

It was to guard against such erroneous modes of speculation, that Bacon, in his *Novum Organon*, dwelt so earnestly on the principal sources of error which had arisen, or were likely to arise, in philosophical speculation, from the neglect of those just rules and principles. The several chief causes of mistake, which lead men into unsubstantial and delusive theories, classified under their respective heads, are what he designates in his somewhat fanciful, but abundantly expressive, language, by the name of "Idola," the false divinities which the mind is apt to raise as the objects of its adoration, when it ought to be engaged in the sole worship of truth.

It is far from my design here to enter into any discussion of those sources of false philosophy. The excellence of Bacon's suggestions, as well as their importance, not merely for the guidance of the philosophical inquirers of his day, but as involving the correction of mistaken ideas, likely to be perpetually recurring, will be recognised by all who have examined his immortal work: and it will be the less necessary for me to insist on them here, since I have elsewhere placed them in a light accessible to the general reader*.

I will merely remark here, that the class termed "Idola theatri," seems to include the chief source of error to which I am here more especially referring: the adoption of artificial systems, founded on an assumption either of fallacious physical principles, or of any whatsoever not physical: the former being essentially false, the latter, however good in their own way, utterly inapplicable to the purposes of physical inquiry.

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* See "History of Physical Science," *Cabinet Cyclopædia*, p. 198.

### *Objections to Physical Inquiries.*

It is from such an erroneous assumption of first principles that most of the prejudices and misconceptions against sound physical conclusions take their origin. Hence originates the charge of presumption in scientific inquiries; hence the accusation of arrogance brought against the deductions of the physical inquirer, especially if they happen to stand in opposition to the preconceived notions and cherished prejudices of mankind, which are in reality far more presumptuous; hence the exclamations against the " pride of science," and the hostility felt against certain branches of inductive knowledge; while the objector is wholly blind to his own inconsistency in nevertheless accepting and adopting the conclusions of other departments, which are yet built on the very same kind of evidence.

This has been especially the case with geology. From ill-informed, or, too often, prejudiced persons, we hear frequent remarks disparaging the inquiries and conclusions of the geologist, while they allow and applaud the inferences of the astronomer and the chemist; they condemn as visionary and presumptuous the results of the one as to the antiquity of strata, and the successive æras of animal organization, the monuments of which are before their eyes, while they revere as unquestionable truths the most marvellous and paradoxical inferences of the other: which refer to subjects utterly beyond the scope of the senses, to periods and distances which transcend our arithmetical powers to conceive, and to processes of nature which exceed our faculties to apprehend.

The mathematician in his study puts down a few characters and figures on paper, and then confidently announces that the matter of which Jupiter is composed, weighs somewhat more than one-fifth of the average weight of the materials of the earth: and that of the sun about one-fourth.

The chemist asserts that a bell glass, which appears empty, is, in fact, filled with a peculiar aërial compound; and invisible and impalpable as it may seem, yet is really formed of a vast collection of solid indestructible atoms; and these of more than one kind, aggregated together by the most perfectly regular laws: and not only so, but he actually states the numerical ratio in which they are so combined, and what is more, assigns the *weights* of these ultimate molecules, which no microscope can ever detect, no balance verify: such conclusions, however, are universally accepted, and popularly held forth as among the most certain truths of science.

Yet when the geologist contends that the crust of the earth, with its organized productions, has been gradually brought into its present condition by a series of creative changes, going on through millions of ages, his conclusion is condemned as chimerical and dangerous.

There is a singular partiality shown to some sciences: the world are disposed to admit, without hesitation, the most inconceivable assertions of the astronomer and optician: they allow the full claims of the powers of the human mind to assign spaces and periods which transcend the flights of the loftiest imagination; to Halley's comet an elliptic orbit whose long diameter is 3,420,000,000 miles, with a period of 75 years; and to a molecule of æther, in a polarized ray traversing a quartz crystal, an elliptic orbit whose long diameter may be about one-5000th of an inch, with a period of about one-500,000,000,000,000,000th of a second; yet they talk of the arrogance of the geologist in pretending to maintain that millions of years ago the world was going on, governed by the same physical laws which prevail now, and replete with vegetable and animal life in all its varied forms of perfection and adaptation to a state of things, of which the existing order is only one of a series of gradual and regular changes.

The true answer to such objections is found in the question, What *sort* of reasoning will you adopt and allow in any such inquiries? Upon this the whole depends. Will you be satisfied with the same sort of evidence as that on which we ground any one of the best established laws of physical truth? Or will you contend that each branch of science is to be established on different arbitrary principles from the others? The very essence of all truly philosophic inquiry is to proceed throughout on one common principle of comparison and analogy, to advance from individual facts to classes of facts;

from some characteristic apparent in one such class to seize upon an analogy with another; to argue from the known to the unknown; to trace the indications of uniformity; to perceive the points of parallelism even in the midst of circumstances the most dissimilar.

Reasonings, then, like those we have above referred to, as assigned for the explanation of existing and observed effects, are not only rational but unavoidable. Theories of this kind *must* be referred to, because they are the *only* kind cognisable in real physical inquiry. We have only the alternative of adopting these, or renouncing all inductive research.

## *Conclusion.*

THE results of science, however remote from ordinary apprehensions, however inconceivable some of the ideas they may involve, however at variance with received notions, are yet not only rational and logical, but absolutely unavoidable and undeniable, so long as we only consent to reason in all cases alike; so long as we only confine ourselves to arguing from the known to the unknown by rational induction; and pursue only the real analogies which are everywhere traceable in the operations of nature, and which we never fail to find continually amplifying and enlarging, confirming and corroborating, each other, at every step of our progress.

By this mutual confirmation of concurring trains of investigation, the evidence of each is enhanced in a continually increasing ratio. The connexion between whole classes of facts by such analogies, augments to an incalculable degree an assurance of their truth; and we advance with a confidence equal to that inspired by demonstration, to many of the most apparently remote conclusions of science: yet with a force of evidence which legitimately demands the abandonment of preconceived notions, and the surrender of long-cherished prejudices, if at variance with those conclusions. This advance and progression from one train of analogy to another is, in fact, the main characteristic which has distinguished the science of the moderns from that of the ancients. It is this increasing and accumulating evidence of uniformity throughout nature, which has been the main cause of the rapid and sure progress of modern science. It has been from following, under the guidance of such principles, the humble and unpretending path of induction, that all its most sublime inferences have been established.

I have dwelt more particularly on these topics, because they seem to be too much overlooked by those who take upon them to disparage, the conclusions of some branches of physical philosophy; and it becomes peculiarly necessary to urge upon their consideration that the evidence is of one and the same kind in all branches: a whole science must not be objected to because it relies solely upon such inductive proofs as it has been our object to explain, and utterly discards and disowns all other authority. If the foundations of one science are to be so assailed, all the others must be involved: all the branches of physical inquiry must stand or fall together on the common ground of their inductive evidence. If the conclusions of the geologist are in principle and method fallacious, those of the astronomer and the chemist must be rejected on the same ground. If causes assigned in conformity to the entire series of natural analogies are to be rejected in one case, the whole principle, method, and system of reasoning on such analogies must be given up.

# SECTION II.

## THE NATURE OF PHYSICAL TRUTH.

## CAUSE AND EFFECT.

" Certainly if the explaining a phenomenon be to assign its proper efficient and final cause, it should seem the mechanical philosophers never explained any thing; their province being only to discover the laws of nature; that is, the general rules and method of motion; *and to* ACCOUNT FOR *particular phenomena, by* REDUCING THEM UNDER, *or showing their conformity to such* GENERAL RULES."

BISHOP BERKELY, (*Siris*, p. 108.)

" Si l'on considére avec attention la série des objets de même nature, on aperçoit entre eux et dans leurs changemens, *des rapports et des lois*, qui se manifestent de plus en plus à mesure que la série se prolonge, et qui, *en s'etendant et se generalisant sans cesse, conduisent enfin* AU PRINCIPE DONT ILS DEPENDENT."—LAPLACE.

### *Introduction.*

IN the foregoing discussion, we have endeavoured to trace and analyse the nature of our conviction of the truth and regularity of the laws which prevail in the material world. We have noticed the natural tendency of our minds to generalize; the intuitive belief in the permanence and uniformity of physical laws; and the immense force of evidence with which analogy addresses itself to our conceptions. These intellectual phenomena harmonise most accurately with what we find by every experimental confirmation to be the actual state of things in the external order of nature. And the certainty with which we thus rely on the invariable truth of sound physical research arises from such a combination of concurrent testimony as to possess a force wholly irresistible even to the most sceptical, and full of the most sublime satisfaction to every well-ordered mind.

By the establishment of correct trains of analogy, the inductive philosopher connects the near and the remote, the minute and the immense, the present, the past, and the future. He argues from the laws of motion on the surface of the earth to those which prevail in the most distant regions of the heavens. He reasons from the forces which act between the minutest molecules, to those which connect sidereal systems. He extends his deductions from spaces subject to measurement under his hands to the most inconceivably remote distances; from æras of human date to the immensity of past duration. He advances from causes which he can put in operation, to those which affect the most immense masses; from action in sensible space and time, to that which belongs to molecules and periods of absolutely unimaginable minuteness; from changes now in progress, he infers those of past epochs; and from the work of actual alterations on the earth's surface computes the succession of those of which he traces the existing monuments. In the midst of the apparent irregularities of the planetary system, he traces order, and in its perpetual fluctuations the principle of stability and security.

Physical analogies are not only allowable helps to the interpretation of nature, but they are the sole legitimate guides. The philosopher is not merely at liberty to adopt them as convenient aids, but he is driven by the necessity of the case to follow them. He has no other means of ever arriving at an acquaintance with the scheme of natural causes. Their reality alone constitutes what we mean by such order. It is the uniformity actually found in certain limited portions of nature which leads to the presumption of its universality. But it is under the guidance of that presumption that every step of physical inquiry proceeds: and the universal confirmation of it is the general conclusion of all our researches. And the further sound induction extends, the more does every fresh inference add force to the claims of some high principle of order to be recognised as pervading all nature. That induction can go on satisfactorily and successfully in every new region of inquiry which may be opened to it, is of itself a proof of the permanence and universality of such order and system.

Upon the foregoing considerations we may, perhaps, more correctly appreciate the standard of evidence to which sound physical philosophy appeals; and the importance of a clear perception of real physical analogies in the study of it. We have, however, already remarked at once the difficulty of explaining the weight which those analogies possess, yet, at the same time, the actually irresistible force with which they impress the mind. And if the evidence be thus in any degree open to difference in its application to different minds, what does this amount to but saying that inductive proof does not amount to demonstration; or, more correctly, is proof of a different kind. But at any rate if it be allowed that there has been no attempt to *overrate* the evidence, this will but give additional security to the important inferences and applications to which we shall advance.

## *Study of Cause and Effect.*

THE more special object of the preceding section has been to examine the nature and principles of the Inductive Method, the characteristic process of the Baconian philosophy. Now the principal aim and object of this system is to ascend from individual phenomena to general laws; from sensible and visible results, up to hidden and abstract principles; from the experimental evidence of sense, up to the abstractions of mind; from *effects*, to their *causes*.

In the present instance it is proposed to carry on the subject by the further examination of the nature of the relation of *cause and effect*, and this, more especially in the first instance, with reference to the causes which we trace in operation in the material world. The *evidence* on which our knowledge of these causes depends is that afforded by induction, which we have already been engaged in tracing; and in proceeding, as we are now about to do, to the more direct consideration of their *nature*, we shall find that this discussion has not been misplaced; and that, in fact, in studying the *evidence*, we have arrived at some of the most important observations for bringing us to the apprehension of the *nature* of physical causes. In tracing the essential grounds of *induction*, it will be found that we have elicited what will be our safest guide in the inquiry into the principle of *causation*.

From the earliest periods at which intellectual pursuits have attained anything like a due place in the estimation of mankind, a high rank has always been assigned to the study of the *causes* of things. Surrounded as we are by the most stupendous scene of natural wonders, it would indeed be surprising if the curiosity of man were not excited, even in an early stage of civilization, to learn something of the nature and source of those effects which he daily witnesses in the magnificent phenomena of the material world. And we accordingly find that from the earliest times at which the human race has been sufficiently advanced to give attention to such subjects, the inquiry into the nature and relations, the dependence and connexion, of natural phenomena, has obtained at least some share of attention; and though pursued only by a few, has conferred upon them, at all times, a certain degree of reputation even among the uninstructed, while with those of more enlightened ideas, a knowledge of the causes of those effects which we daily witness has been regarded as among the highest objects of intellectual attainment; and to be permitted thus to penetrate, as it were, into the hidden processes by which nature works, has been esteemed the most elevated privilege of philosophy. It is a species of knowledge of extreme interest and value in itself, and embraces in its applications, some of the most important and even momentous questions which can occupy human contemplation.

### *Meaning of the term "Cause."*

In order to pursue our inquiry into the nature of Physical Causes, it will be essential, in the first instance, to distinguish, as clearly as we can, the meaning annexed to the term.

In common language, the term "*cause*" is used with considerable latitude of meaning; and even in many discussions pretending to a philosophic character, a slight examination will show that it bears several distinct kinds of signification. We are apt to use the *same word,* and thence imagine that we are speaking of the *same thing,* in cases which are essentially different; though there is doubtless enough of apparent resemblance to mislead inaccurate thinkers into the notion of identity. Hence the ambiguity and fallacy which prevail in some of the most important inquiries connected with this subject; and the manifest necessity for attention to accurate distinction of the meaning of terms.

In ordinary affairs, we talk of the "cause" of an undertaking, or the "cause" of our conduct. Again we speak of the "cause" of an historical event; and we apply the term to matters of reasoning or belief in the conjunction "because." We mean the *motive* of our actions; the *ground* or *evidence* of our opinion; the train of circumstances which *brought about* an event in history. In these and the like cases, we may trace a general analogy, which has led to the application of the same term. In all of them we refer to some sort of *moral influence* exercised either by concurrent circumstances upon human motives or convictions, or by human agency (individual or collective) upon events.

In the discussion of causes and effects, as we contemplate them in the natural world, and in connexion with physical science, it is more especially necessary to guard against the vague use of terms. And in proceeding to the more precise examination of the nature of *physical causes*, we may consider more particularly, as a preliminary illustration in the way of contrast, two familiar instances of the use of the term "cause."

We may say the *cause* of the motions of a watch is the tendency of the main-spring to unwind itself;

and the *cause* of the flight of the cricket-ball is the voluntary effort of the player. These are two instances which would seem, at first sight, closely to resemble each other; but when accurately examined, we find an important distinction between them. In the former instance, we trace the order of dependence of the motions from the index to the wheels, from the wheels to the fusee, and so up to the tendency of the spring to unwind; and this we refer to the property of elasticity; which again may possibly depend on some still higher principle in the nature and arrangement of the particles of which elastic bodies are composed. But to whatever extent we may advance in thus analyzing the effect up to its simplest elements, one thing is all along manifest; viz., that the very highest principle of any such series must essentially be some general, fixed, inherent, property of matter; by virtue of which it is capable of being influenced in particular ways, and by particular agents; but yet is wholly *inert*, and incapable of *arbitrarily* originating any of the effects referred to.

In the second case, we may observe, it is true, a like series of effects in succession dependent one on another. Motion is communicated mechanically to the ball from the sudden action of the arm; this results from the contraction of the muscles acting on the bones as levers; the muscular contraction again may be shown to depend on some peculiar influence of the nerves; this again may possibly be traced to some higher principle; we may advance, in short, as far as physiological science can carry us; and thus far, this and the former case are exactly alike. But here at the commencement of the whole train, there must still be an *influence* or *cause* of some kind different from any mechanical power; depending on *voluntary agency*; capable of originating the series of consequences from itself; acting by different laws from those of matter; in a word, an agency or influence of a *moral* kind: Or (in the graphic language of Sir J. Herschel*), we must include "a distinct and immediate personal consciousness of causation in the enumeration of that sequence of events by which the volition of the mind is made to terminate in the motion of material objects; I mean the consciousness of effort, as a thing entirely distinct from mere desire or volition on the one hand, and from mere spasmodic contraction of the muscles on the other."

Such a voluntary agency, such an influence or power, of which we feel conscious, and which implies the action (however incomprehensible,) of mind on matter, is what we may properly distinguish by the term "moral causation." The former case we may call, by way of contradistinction, an instance of "physical causation." In the study of causes acting in the natural world, we must carefully observe this distinction. Cases where voluntary or moral agency is concerned, can only be considered in physical inquiry so far as they properly come under the laws of inert matter, or belong to those kinds of *physical* action which are the subjects of dynamical or chemical research. To go beyond this is to confound physical causes with moral, physical science with metaphysical.

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* *Astronomy*, p. 232.

Observing this distinction, it would no doubt tend much to the promotion of accurate views if we could succeed in agreeing to disuse the term "*cause*" in one or other of these very distinct cases. But as custom has probably established the use of the term beyond the possibility of change, we must content ourselves by insisting strongly on the careful and constant adoption of *some such* distinctive appellations as those above suggested.

We have thus far merely contended that physical causes are such as *are widely distinguished* from moral; but we have not yet considered *what their essential nature* is: to this we now proceed.

### *Nature of Physical Causes.*

In the study of physical causes there has been, doubtless, and still exists, a strong tendency to lose sight of the distinction just laid down; and from the familiar notion of moral causation, to imagine a similar sort of influence in the production of physical effects: to transfer the idea of voluntary power as experienced in ourselves to mechanical agents; and by a creation of the fancy, by a sort of personification of the powers of nature, to invest physical, with the attributes of moral, action. But such indulgence of the imagination is here worse than idle; it has a direct tendency to confuse and entangle the chain of reasoning; and this consideration becomes of more importance in reference to the conclusions founded on physical inquiry. On all grounds, then, we ought surely to keep the search into physical truth as free as possible from such incongruous influence; and soberly investigate physical causes without being misled by the adoption of ideas so foreign to the subject.

Yet notions more or less allied to these have been prevalent among philosophers. This propensity for physical mysticism was pre-eminently fostered in the labyrinths of the scholastic and Cartesian systems of a past age. But the traces of it have not yet been wholly or effectually banished from our schools of science.

Even in later times many philosophers have sought to establish the notion of what they termed a " necessary connexion" or " efficient causation" in natural phenomena; an idea which nevertheless it would appear very difficult distinctly to explain.

It would seem as if they regarded material substances as possessed of some hidden virtues or properties, which confer on them the powers of physical agents; and imagined these occult qualities the secret soul which animates, as it were, the whole frame of nature.

In some instances, the adoption of these ideas may be traced to associations arising out of the common use of metaphorical language*. We talk of the *chain* of cause and effect; the *links* of that chain; the *connexion* of one event with another; the *dependence* of causes; the *production* of a result from its cause. These metaphors being taken from material objects, insensibly lead many minds to suppose some similar, real, and effective union between the events. But this is nothing more than the very common mistake of straining a metaphor beyond the points of parallelism, in which it properly applies, to others which are wholly incidental. Perhaps we might rather say these metaphors themselves have been adopted and conceived upon a false train of analogy. At any rate, if we retain the use of them, we should be careful not to be misled by the phraseology we employ into ideas at variance with the real nature of the relation intended to be expressed by it.

Another source, perhaps, from which these notions of " efficient causation" have derived strength, may be discovered in the vague conceptions which have sometimes prevailed with regard to the nature of mechanical forces. We might instance some speculations on the nature of " inertia," and the communication of motion; as well as others connected with the questions once agitated respecting the "vis viva." Or, to take a more familiar example, the indistinct notions which frequently involve in a singular degree of mystery, the advantage obtained in the use of the mechanical powers. On witnessing the effects produced by these contrivances, the untaught mind can hardly help imagining a sort of creative energy which invests matter with new attributes, and supplies a source of active power capable of almost indefinite increase. Scientific investigation, indeed, dispels the illusion, yet it often continues to haunt both our language and our ideas relative to the nature of causation.

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* *Idola fori.*—Bacon.

## *Opinions on the Nature of Causation.*

Whether, however, originating in such misconceptions or not, whether pushed to a greater or less extent, some notions of this kind have prevailed very generally. But reasoners of an opposite school have arisen, who, aiming at a peculiar degree of precision and rigour in their speculations, have utterly denied and discarded all ideas of such active, efficient influence, which, they contend, is altogether chimerical; and have sought to reduce the whole nature and conception of cause and effect to the bare, naked, matter-of-fact, learnt from experience, that some one particular event or phenomenon in nature always invariably follows another in order of time; the former being termed the effect, the latter the cause; that besides this mere invariable "*sequence*" (as it is termed), they have no other kind of connexion or dependence one on the other; all we know or can know of the matter is the simple fact, that such sequence does universally hold good; and that we cannot reverse the order. If we be prone to entertain the idea of any higher or more intimate connexion, this, they contend, is only a vague prepossession, utterly inadmissible in exact philosophic inquiry.

Against these views considerable objection has been raised; often, doubtless, from the *abuse* of them; because they were too exclusively dwelt upon, or pushed to unwarrantable extremes in their application.

But apart from these objections, the generality of inquirers seem to have felt unable to rest satisfied in a view of the subject apparently so little calculated to gratify the cravings of our intellectual curiosity, and seeming to conduct us to so little an extent into the secret workings of nature which we are so desirous to penetrate. They have generally yielded to the seemingly more natural but vague persuasion, that there is yet in the relation of cause and effect, some real, hidden, essential energy, which pervades and actuates all the operations of the material world.

And some, even of the most truly philosophic minds, have been unwilling wholly to acquiesce in reducing the notion of causes to what has appeared to them the barren and unsatisfactory relation of a mere invariable junction and sequence of facts; they have been unable to divest themselves wholly of some sort of idea of one event actively *occasioning another*, and not merely passively preceding it; of an influence of some kind, an intimate connexion, an efficient agency, beyond the bare constancy of a "sequence" or invariable law*.

### *Physical Causes.—"Sequence" of Phenomena.*

***Is, then, physical causation really nothing more than the bare invariable sequence of two facts?*** To treat the subject fairly, we must of course dismiss, in the first instance, a number of cases which have been often urged against this doctrine, but which the slightest reflection shows to be either frivolous or inapplicable; some such instances are not real invariable sequences of one phenomenon after another; others involve the fallacy of the logician's "non causa pro causâ;" others are mere statements of the co-existence of two constant properties.

We restrict our view of cause and effect to cases in which some *change*, either in properties, or in relation or position, occurs; that is, where either some chemical effect or some mechanical motion is produced. To take one or two simple instances of what are properly physical causes and effects: we say "friction is a cause of heat:" "the action of an acid is the cause of a vegetable blue turning red." The ancients (ignorant of gravitation) considered "the moon to be the cause of the tides."

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* See Note C.

In such cases as these there is clearly the invariable association of one fact with another, by a sequence in order of time. Thus, whenever we rub two substances together, under all circumstances, the effect of heat follows; and in greater intensity as the friction is more violent: it depends on this and on this alone. In the strict use of terms, then, in this and the like cases, our proposition is nothing more than the affirmation of this invariable relation of sequence, as a result of universal experience.

In these instances, then, we have a precise exemplification of the doctrine of invariable sequence constituting the whole nature of cause and effect. We observe only such an inseparable relation between the two facts. We may doubtless *imagine* some higher principle, to account for the production of heat in the one case, and of colour in the other, as the ancients might have *imagined* (and, perhaps, did so) a sort of principle of attraction in the tides: but whatever we may *imagine*, we *know* nothing. When these and the like cases, then, are contemplated in a strictly inductive point of view, we are obliged to admit that nothing is actually proved beyond the invariable "sequence."

### *Causes referred to General Laws: Examples.*

A DIFFERENCE may, perhaps, be traced between such instances as these last referred to, and some others which we may adduce. For instance, when we say that "pulsations of air are the cause of sound," it will be immediately felt that some relation, of a kind more satisfactory to our minds, is here affirmed than in the former cases. There is manifestly an invariable sequence; whenever this sort of pulsation is produced, sound invariably follows, and never without it.

But besides this, the propagation of tremulous waves, or pulsations, through the air is a mechanical effect, of which we form a general idea apart from its influence on our organs; and we refer the vibrations produced in the membranes of our ears, and the sensation which ensues, as a *particular case*, to the *more general fact* of pulsations of elastic media. Here, then, there is *not only* the sequence of one fact upon another, but, *also*, the former is *more comprehensive*, and includes the latter as a particular case of a more general class of phenomena.

In the same manner, we say that rapid *chemical combination* is the *cause* of that evolution of heat and light which we call *combustion*.

Here, again, we refer the particular effect to a cause of a *more comprehensive* kind: what we mean to affirm is, that combustion is a peculiarly rapid and intense *species* of chemical combination. Again, when we extend the bare matter-of-fact connexion which the ancients perceived between the moon and the tides, to that view of the case which is now afforded us by the doctrine of universal gravitation, acting between the sun, the moon, the solid earth, and the waters on its surface, we arrive at a far more generalized sort of relation; we refer the phenomenon not only to an invariable *sequence*, but assert the dependence of a *particular* effect upon a very *general* principle: we mean that the tides are *a particular case* of the universal law of gravitation.

The same may be said of our assertion, that "electric discharge is the cause of lightning and thunder;" that "volcanic action is the cause of earthquakes;" in a vast number of such instances, what we really mean will be found to include a reference to a *more general* fact, law, or principle. We mean, that lightning and thunder are *a particular case* of electric discharge; or are reducible to that greater principle: an earthquake a *particular case* of the effect of volcanic force: that is, in all such cases, we use the term cause to include the idea that the one phenomenon (which we call the effect) is a *particular kind* of the other (or cause) which is the *more general* fact: the relation is not only that of sequence, but also that of a species referred to its genus.

When the suspension of water in the pump was first observed it was ascribed to a cause called "suction," and in the then state of knowledge, it was not only natural, but inductively correct, to ascribe so singular an effect to a peculiar cause. It was apparently a case "sui generis:" the effect was, perhaps, soon seen to be of the same kind as the suspension of a stone by contact with the under side of a wet leather; there was then *one step* taken in the process of generalization, by referring both to one *common* cause, still named suction. Further, the discovery of Torricelli referred the former case to the pressure of the atmosphere; and this was soon seen to include the explanation of the latter and all other analogous phenomena. And, finally, this was reduced under the still more comprehensive law of universal gravitation. Thus the gross and heavy matter of the earth (as the scholastic systems considered it), and the pure and æthereal substance of the atmosphere, were brought under the common dominion of one simple and general law. Thus the study of causes proceeds from the first admission of a peculiar phenomenon as a thing "sui generis," until it is shown to be reducible to a species of some more extensive established "genus."

When a narrow beam of solar light passes the sides of a wire, or the edges of an aperture, certain coloured stripes or fringes are exhibited on a screen placed at some distance. These facts were at first ascribed (very justly) to a *peculiar* property of light; which was termed "inflexion," or sometimes "diffraction."

The colours of soap bubbles, or those between two glasses pressed hard together, were ascribed by Newton to another *peculiar* property of light, by virtue of which it has different characters alternately, at successive intervals, along the length of the ray. These alternations of character were termed "fits."

Some other phenomena of an analogous nature were, in like manner, set down as due to properties of light, each entirely "sui generis."

At length, however, it was shown by Dr. Young, that they could all be reduced to a common principle (or genus), named "interference;" (before alluded to† ;) and which supposed two rays of light capable of either conspiring in their effects, or neutralizing each other, as they coincided at similar or dissimilar points or periods, at alternate minute distances along their lengths*: and such a property was accounted for by the supposition of light consisting in *waves* propagated through an infinitely rare and elastic medium.

When a ray was transmitted through certain media, or reflected at a certain angle, it is found to have different properties *along its opposite sides*. This was a distinct fact, and was referred to a peculiar cause, termed "polarization."

When polarized light is received through a tourmaline (or other analyzing apparatus) in a particular position, it wholly *disappears*. But if a plate of certain crystals be interposed, a portion of the light, or certain particular colours, are *restored*. This, again, was considered at first a distinct property, and was called "*de*polarization." It has been, however, since perfectly *explained* by the general principle of "interference," *if combined* with an explanation of polarization, which is also easily supplied by referring it to the same general theory of waves.

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* See my *Treatise on Optics*, p. 125, Oxford, 1833.

† See above, p. 53.

The cooling of the earth at night is the cause of the deposition of dew on those substances which cool fastest, from the condensation of the suspended moisture of the atmosphere upon them. Here the cooling or radiation of the earth, considered merely as any other heated body, is a greater or more general principle; such also is the more rapid cooling of fibrous substances; and such, again, is the suspension of invisible vapour in the atmosphere, and its condensation on a certain lowering of temperature. We are thus enabled to refer the particular instance of the dew on the grass (and not on the gravel) to a union of these more general principles. Here, then, we have a combination of causes, involving a far more satisfactory and intimate kind of relation.

### *True and Hypothetical Causes.*

THIS will be the proper place to notice an important distinction, often not clearly kept in view. We may refer to a cause, or general principle, which is likewise independently established by other experimental evidence as something actually existing in nature apart from the particular cases we were at first considering.

But also, in other cases, we may find some mere gratuitous supposition or hypothesis which supplies a connecting principle or general representation of the facts, though in itself purely fictitious. Such a principle is sometimes termed a "cause," as well as the former. And such cases have been compared to the discovery of a key to a cipher, obtained merely by finding, from repeated trials, that, in point of fact, it *does* supply an interpretation. And some writers have contended that this is all we want in inductive philosophy, and would restrict the study of causes solely to this object. The illustration, however, at best appears to me to convey but a miserable idea of the investigation of physical causes; and if adopted exclusively, cuts off the most valuable and satisfactory subjects of physical inquiry.

Newton (at the commencement of the third book of his *Principia,*) has laid down certain rules for the study of physical causes; the chief of these, and a rule supported on the soundest considerations, points out *two* conditions as the characteristics of legitimate physical causes, viz., that they be such as are "*true,*" and "*sufficient to explain the phenomena.*"

Now an hypothetical cause (or the mere key to the cipher,) fulfils but *one* of these conditions. Nevertheless such hypotheses may be eminently useful, especially when we can attain to nothing better. With the reference to such principles, we are often compelled to be satisfied. They afford a good representation of the facts, though they have no other existence than as so representing them.

But on all grounds, it is a far higher and more satisfactory process if we can arrive at such a cause as fulfils *both* Newton's conditions; such as not only affords a key to the phenomena, but is also "true," or is proved to be a real principle existing in nature by other and independent considerations.

## *Examples in Physics.*

1. THE varied phenomena of electro-magnetism are all explained by the supposition of a system of currents in directions transverse to the length of the needle. But these currents are not proved to exist by any independent evidence. This, then, is an instance of an *hypothetical* cause, which yet *explains* the phenomena.

2. On the other hand, the air is a medium really and independently known to exist; and pulsations are real mechanical effects produced in it. The phenomena of sound are thus referred to a "real cause," which perfectly "explains" them.

3. The explanation of dew before mentioned is also an example of combination of "true" causes.

4. We before alluded to large classes of optical facts which are reducible to the principle of "interference." That rays of light actually possess some inherent property by virtue of which they can so

interfere, has been shown by independent experiment, by Arago and Fresnel. Interference, then, is a *real* effect; and these classes of facts are *explained* by a "*true cause.*"

The fact of interference itself is again *explained* perfectly by the theory of waves, propagated in an infinitely rare and elastic medium; also a vast number of other optical facts which have no connexion with interference, and others which have, are all capable of exact explanation by this hypothesis of waves; which, when modified by some peculiar considerations, seems likely to afford a clue to nearly all the most complex phenomena of light. Yet we have no *independent* proof of the existence of an æther, or the propagation of waves in it. It therefore remains at present an *hypothetical* cause.

5. Gravitation, or the tendency of matter to fall together with a force proportional directly to the mass and inversely to the square of the distance, is a *real thing;* we find it independently and experimentally in the attractions which take place within the reach of our investigations; we also find that the extension of the same cause perfectly *explains* all the movements of the planetary system.

### *Examples in Geology.*

6. THE phenomena presented by the actual state and structure of the earth's surface are such as both

admit and call for inquiry into the nature of the causes to which they can be referred.

The pursuit of this inquiry soon discloses the evidence and monuments of successive changes which have occurred in the state of the earth's surface. In the attempt to trace these to their causes, sound inductive geology recognises, of course, the same principle of referring to those which are both *true*, and *sufficient* to explain the phenomena. We cannot find true causes except in such as are really proved to exist, and found by experience to be in operation. The action of the waters on the land, (whether the continued power of the rivers and ocean, or the occasional force of inundations and torrents,) the subterranean force of earthquakes, and the external operation of volcanoes; the contractions and expansions which must accompany changes in the temperature of any considerable thickness of the earth's crust: these and the like are the *real* causes to which the sound geologist refers.

The accumulation of soil at the bottom of the waters, the imbedding of animal and vegetable remains in those depositions, the elevation of portions of land out of the sea, are operations really and continually going on. When, therefore, fossil remains of organized beings are found imbedded in rocks bearing also the marks of a similar mode of deposition, we refer to such operations as those just mentioned as *true* causes to *explain* the phenomena. And numerous series and successions of such deposits, containing the remains of species now extinct, and, successively in the order of deposition, containing fewer of recent and more of extinct kinds, even to whole genera, classes, and orders of beings, call for the like reference to the continued action of similar causes through periods of countless duration.

And even if difference of opinion arise among geologists as to the rapidity with which such changes may have been effected, yet no sound inquirer refers to causes of different *kinds;* no one now dreams of the plastic power of nature moulding the semblances of organic remains in her sportive moods; nor of the simultaneous formation of the different strata with all their fossils in one confused mass, from which they subsided at once into their present positions.

The continent of Sweden is shown to have been slowly rising, by elevation in a mass, above the level of the Baltic, by a gradual, insensible movement, unattended by any violence or dislocation; the effect of some enormous subterranean pressure.

Here, then, is a *true cause;* it is also one which *perfectly explains the phenomena* presented by numerous other large districts of the earth; which, containing immense deposits of marine shells, must once have formed the bed of the sea, above which they are now elevated; and exhibiting an unbroken level, we infer were elevated gradually, and without disturbance, by similar slowly-acting subterranean forces, as *true* causes, and sufficient to explain the phenomena.

In the tremendous earthquake which occurred on the coast of Chili in 1835, an eruption of a submarine volcano caused an enormous wave which swept over and entirely desolated a considerable tract of country. The geologist traces the marks of such sudden and violent *local* inundations in various parts of the earth at remote epochs. Here, then, we have a real cause which explains them. And if, in some instances, the effects appear to have taken place formerly upon a larger scale, still we are not departing from the nature of a real cause in supposing submarine eruptions of greater violence.

Thus, while no difference of opinion exists among rational geologists as to the propriety of attempting to explain the facts solely by reference to "true" causes, questions have, nevertheless, been, and may fairly be, agitated, as to the frequency or intensity with which such causes may have operated in remote periods; and whether we should with greater probability lean to the idea of brief eruptions of enormous violence, or of long-continued action of ordinary energy. Such questions are clearly matter of fair and philosophical discussion. But the important point to be borne in mind is, the distinction between such suppositions as those, and speculations which would refer the effects in question to other agency of a *different kind*, and which has not any connexion with the legitimate objects of inductive research.

The questions at issue between certain geological schools refer only to a difference in the *degree*, not in the *kind*, of action supposed. The case is essentially distinct from any chimera of universal catastrophes and convulsive paroxysms.

Volcanic action, in a single day, has been known to raise a hill of some hundreds of feet in height. The elevation of a mountain peak of as many thousands may be ascribed by one geologist to the sudden action of volcanic energy a thousand times as great; by another, to an equal force acting through a thousand days. The probable reasoning in support of either supposition, must be made out from concurrent circumstances. But the important point is, that in either case, the theorist is not departing from known analogies and real causes. The man who should contend that the volcanic appearance of the mountain, together with all the marks of upheaving and disruption, are delusive, and that the whole was formed at once out of primæval chaos, exactly in its present condition, would be fairly divested of all claim to the title of a geologist, or of a rational inquirer.

The question respecting the explanation of geological phenomena solely by existing causes, seems, like many other controversies, to be in a great degree, dependent on the meaning of *terms*. It has been contended that we ought to appeal as much to unlimited *force* as to unlimited *time*. But it appears to me that the unlimited extension *in time* of the operation of known causes is an assumption essentially distinct from that of an unlimited extension in intensity, this last being precisely that which would place them beyond the limits of known and real causes. It is undoubtedly true that we know causes only by their effects, and must infer the magnitude of the cause from the nature of the effects witnessed; but the very question is, whether we are to derive this magnitude by the multiplication of the time or the force. And (unless where there is positive evidence of the *suddenness* of the effect from collateral circumstances,) the former is the method which alone seems to bring us within the dominion of known causes.

Again, even those theorists who have been most disposed to adopt the supposition of sudden and enormous paroxysms of volcanic and diluvial action in the earlier stages of the condition of the earth, have never supposed them as extending over more than certain limited regions of the earth at one time. In fact, all the changes of which we have evidence in past epochs, have been manifestly *local.* And the operation of existing causes is confined to a series of the like partial and local alterations. Thus no sound inductive geologist at the present day can admit anything like an *universal simultaneous* formation; nor find support for any theory of a sudden cosmogony, applying at once to the entire surface of the present dry land. One small portion after another has been successively elevated and peopled with vegetable and animal life; again, in the course of profoundly-adjusted changes, to be obliterated and overwhelmed, while another has been in progressive advance.

In all such cases, then, the observed fact or result is referred as a particular case or species to some real existing genus or class of natural operations, and not left as a peculiar anomalous event, *sui generis*, or referred to arbitrary agency.

Causes whose existence and operation is evinced by experience, are the "true" causes to which alone we can refer. Yet questions may fairly arise, and indeed must be carefully discussed, relative to the other condition of the case, viz., whether any particular causes so assigned are *sufficient to explain* the phenomena? If they are not, we then fall back on the truly philosophical maxim so admirably laid down by Mr. Lyell: "When we are unable to explain the monuments of past changes, it is always *more probable* that the difficulty arises from our ignorance of all the existing agents, or all their possible effects in an indefinite lapse of time, than that some cause was formerly in operation which has ceased to act."

## *Connexion of Causes.*

THUS the consideration of a "real cause," in fact, involves the *connexion* of one train of causes with another. The cause is shown to apply independently to one set of phenomena; we refer another class to the same cause. Thus we enlarge our ideas of the connexion of physical phenomena; we trace not only one series of causes and effects, but many, and these not independent, but united by common principles. We perceive a union between extended orders of facts. We find not merely one relation established, but a communication opened, as it were, with a vast range of such relations; and many such channels of communication, widely ramifying in all directions. The great truths of the natural world are proclaimed, as it were, not merely by the accordant evidence of a few witnesses, but of a vast number; and with the increasing assurance, too, that as many more as we may summon, will all confirm each other's statement. And this not merely in one or a few points, but in connected trains of narrative; and again, not only in one or a few, but a great number of distinct narratives, all of which throw light upon, and corroborate each other; and the number and extent of which is increasing and accumulating without limit.

### *Ideas of Efficient Causation.*

By such considerations as those now adduced, it appears to me that we obtain a view of the relation of physical cause and effect at once simple and satisfactory; divested of mystery, yet rising above the relation of a mere invariable "sequence" of facts. We find the connexion of causes and effects in the connexion of laws and principles. And in the most strictly philosophical view of the matter, we rationally extend our notion of physical causation beyond the bare circumstance of two consecutive phenomena, to the conviction of an intimate union between them: which is no other than that of the particular individual case with the more general law: of that law with some still more comprehensive principle: and of this, again, in its turn, with some yet more universal theory: thus establishing not merely sequences but reasons, not merely connexions but explanations.

We may thus safely admit that our persuasion of an intimate causality (if rationally explained) is really something more than the mere influence of an ill-regulated imagination improperly intruding itself upon philosophical speculation. We thus sufficiently account for the most powerful conviction of a hidden connexion between natural events, which we experience even before the grounds of it have been distinctly analysed. In the successively higher generalizations which really constitute what is so improperly represented by the common metaphor of the "chain" of causes, we find a real and rational gratification of our longing anxiety to penetrate beyond the bare surface of sensible phenomena into the more hidden relations and mysterious combinations of nature.

If further confirmation of this view of the matter be wanting, we may find it in observing the dependence which the *strength* of our impression of an intimate causality always has upon the *extent* to which we trace the *series* of combinations of laws and principles.

The force of the persuasion we entertain of causation *varies* with the different degrees in which the relations of physical laws are more or less general, more or less widely ramified and dependent one on another, more or less connected with high general principles and comprehensive theories. Our impression of the idea of an efficient cause is much weaker, for instance, in the case of friction and heat, than in that of gravitation and elliptic orbits, or tides.

Suppose we should hear it reported that some substance had been found in which no violence of friction would produce heat; in estimating its probability prior to evidence of the fact, I believe no truly philosophic inquirer would reject it as a violation of the order of natural causes. But suppose it should be rumoured that a new planet was discovered, but that it did not move in an elliptic orbit; I imagine this circumstance would cast suspicion on the credit of the whole statement, in the minds of all who understood the nature of gravitation.

Or, again; suppose it should be stated that at a certain port, on a certain day, the tide did not occur; rather than believe that there was actually no attraction of the water by the moon in that particular instance, we should adopt any supposition of currents, winds, &c., or even rest in the mere possibility of some counteracting cause, though wholly unable to assign its nature, as the more probable and rational idea.

We have a far *less* powerful persuasion of an inseparable connexion between the action of an acid and the red colour which it produces, than of that between a high charge of atmospheric electricity, and the production of thunder. And the reason seems to be, that, in the former case, we know only the bare law that such an effect *is* produced: in the latter we know something (at least) of the reason *why* and the manner *how* it is produced. In the former we do not know any intermediate step in the process, any intermediate circumstance in the order of causes, we have no succession of generalizations: in the latter we can trace several. For instance: high electric tension always tends to a discharge: a sudden discharge of electricity always produces a flash and a violent concussion of the air: the concussion of the air always occasions a report in our ears. We could not imagine an instance where this ultimate effect was not produced without a violation of *several distinct* laws of nature. In the former case only *one* law would be violated if the effect did not take place. Now so firm is our persuasion of the uniformity of nature, that we cannot bring ourselves to believe in the capricious violation even of *one* of her laws; we, therefore, are prone to regard the violation of *several* in succession, as absolutely contradictory and impossible.

### *Conclusion.*

THE study of physical causes has been by some writers disparaged and calumniated as of a low and confined character; as being wholly limited to the bare investigation of *facts*, and as incapable of rising above such knowledge as is directly conveyed by the *senses*.

The view in which we have here contemplated it, will completely vindicate it from this charge. It is manifest, from what has been advanced, that the study of physical causes, even in the strictest sense, involves the very highest abstractions, the exercise of intellectual combinations, of a nature the most widely remote from the evidence of sense.

We have traced a gradation of meaning, from the bare law that one phenomenon is invariably joined and co-extensive with another, up to associations of facts and laws of successively higher generality; we assign *causes* of a better and more satisfactory nature, by assigning more general theories or systems of truths to which the particular cases or *effects* are to be referred.

In this point of view, then, the study of physical causes becomes identified with that of the *general laws* of the natural world. And it is here, therefore, that the nature of *causation* is found to be immediately connected with that of *induction*, by which alone those laws are elicited and established.

The experimenter is, doubtless, in the first instance, concerned entirely with the bare order of sensible facts: but from these it is the very object of induction to lead him to higher principles, to guide him to the contemplation of the wider generalizations which open to him as his view enlarges, as he is continually rising to more elevated laws and loftier abstractions.

We recur, then, to the accurate study of *induction*, in order to understand the ground of a rational conception of physical *causes:* which is, in fact, no other than that on which all sound induction proceeds: the extended evidence of natural analogies: the conviction of a close union and conspiring harmony throughout the whole range of natural phenomena; such that we cannot imagine even a partial dissociation which would not entail more extensive disarrangements, and involve a disorganization, of the system of material things.

It is the combined force of many conspiring relations which tends to impress the mind with a persuasion of the intimate connexion between physical phenomena which we call cause and effect. It is this support which each distinct truth ministers to another; this mutual corroboration and confirmation of physical laws, which constitutes the notion we can hardly avoid forming, of a consolidating and connecting *power*, or efficient causation, between phenomena, which maintains them in union.

This confederacy of causes, (as Bacon* emphatically terms it,) this adjustment of one to the other, it is, which compacts the whole series of physical laws, in a self-supporting equilibrium, like the stones of an arch, so that we cannot conceive the removal of one portion without the destruction of the whole.

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* *De Augmentis.* I,

We shall thus be prepared to pursue the highest and most important considerations which arise out of the philosophy of physical causes. We connect those causes with universal laws; we learn those laws from inductive evidence: and the combined effect of the whole body of physical induction is to demonstrate the immutable uniformity and recondite adjustment pervading all nature. And the further inductive generalization, or, in other words, the study of physical causes, may be carried, the more abundantly do we find those conclusions confirmed. The mutual corroboration and conspiring testimony of endless concurrent inductions, advances and augments, in an accumulating ratio the overwhelming evidence of order and arrangement, of analogy and harmony, throughout the physical world.

THE

# APPLICATION OF PHYSICAL

TO

# DIVINE TRUTH.

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I. THE RELATION OF PHYSICAL SCIENCE
TO NATURAL THEOLOGY.

II. THE RELATION OF PHYSICAL SCIENCE
AND OF NATURAL THEOLOGY
TO REVELATION.

# SECTION III.

## THE RELATION OF PHYSICAL SCIENCE TO NATURAL THEOLOGY.

"*Human* knowledge is in truth the interpretation of those laws that *God* himself has impressed on his creation."
Babbage, (*Ninth Bridgewater Treatise*, p. 24.)

"Hæc cum meditaris studiosè, *invenies Deum.*"
Luther, (*Op.*, vi. 204.)

"Namque eos qui autumant nimiam scientiam inclinare mentem in Atheismum, ignorantiamque Secundarum Causarum pietati erga Primam obstetricari, libenter compellarem Jobi* questione, 'An oporteat mentiri pro Deo, et ejus gratiâ dolum loqui conveniat, ut ipsi gratificemur? liquet enim Deum nihil operari ordinatio in naturâ, nisi per Secundus Causas, cujus diversum credi si vellent impostura mera esset, quasi in gratiam Dei, et nihil aliud quam Authori veritatis immundam mendacii hostiam immolare.'"
Bacon, (*De Augm.*, i. 1.)

"Adeo ut tantum absit, ut causæ physicæ homines a Deo et providentiâ abducant, ut contrà potius philosophi illi qui in iisdem eruendis occupati fuerunt, nullum exitum rei reperiant, nisi postremo ad Deum et providentiam confugiant."
Bacon, (*De Augm.*, iii. 4.)

### *Introduction.*

In the preceding remarks, we have pursued an inquiry into the nature of physical causes; and in introducing this discussion by an examination of the nature of inductive evidence, by which all our knowledge of physical causes must be obtained, it has probably been made sufficiently manifest how intimately the principle of inductive generalization is connected with all our substantial and satisfactory ideas of cause and effect.

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* Job xiii. 7.

It appeared in the first instance, that a belief in the permanence of uniformity, and the preservation of analogies throughout nature, is in fact the very soul of the inductive philosophy. This supplies at once the first conjectural guide to our belief in fixed physical laws, (without which the very process of induction could not be carried on). And the unlimited extension of it is the grand and universal conclusion to which all experimental evidence leads, and to which all induction ministers increasing and abundant confirmation. In considering further our natural persuasion of the intimate connexion of physical cause and effect, I have endeavoured to explain it by regarding it as dependent simply upon the continually accumulating force of inductive evidence, and the endless order and mutual dependence of vast series of physical laws, of successively higher generality and wider comprehensiveness.

Having thus examined the nature of physical causes, the extent to which we trace their influence, and the origin of our ideas of a necessary connexion or efficiency in them; and having further considered the entirely distinct nature of what is commonly described by the same term "cause,"—but which ought to be carefully distinguished in meaning when thus used in the sense of *moral* causation, the effect being dependent upon volition or intelligence,—it will become necessary to examine further, What are the circumstances under which we can recognise the operation of *moral causes?* and What the evidence by which their existence is substantiated?

### *Evidence of Moral Causation.*

In pursuing the inquiry into the evidence we have of the influence of moral causes, we have only to bear in mind the distinction at first laid down; by the aid of which, it will be apparent how the operation of moral causes is distinguishable from the succession of physical. Moral causation, as we have observed, implies volition and intelligence: it is consequently marked by the indications of intelligence in the results produced. In the illustration before given*, we supposed a known intelligent agent exerting a physical influence on matter. If we witness only effects produced on matter, how are we to recognise an unseen intelligent agent, is the question now before us.

To recur to an illustration similar to that before employed:—If a stone strike against an object, it may have been projected either by some merely mechanical power, or by a voluntary agent; and if we saw only the resulting impact, and not the origination of the motion, we should be unable to decide which was the cause. But if we saw a number of such projectiles striking the object in succession, and all hitting it upon a certain mark, we should immediately conclude that the projectiles were *aimed* at that mark, and, therefore, that the whole was the result of some moral volition. And further, if we should see that the balls were impelled by the aid of a machine, and should find that it was so constructed as to discharge a number successively, without the intervention of any manual agency, this surely would in no way *diminish* our impression, that the whole was designed, and originally set in action, by an intelligent agent. Nor, again, would it make any difference in our conclusion, whether or not we could discover any particular end which might be answered in striking the object; though, if we should perceive or conjecture such a design, it would of course add a further confirmation of our original impression.

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* Above, p. 80.

If, on the contrary, we perceived the balls projected at random, at irregular intervals, and in various directions, we could not infer such design or intelligence. In a word, from results apparently capricious, from effects uncertain and interrupted, from action regulated by no seeming plan, but of an arbitrary and inconstant character, we could infer no design, no volition, no *moral cause.* It is when results are reducible to regular rules, when observed actions are found to be consistent with some fixed and constant system; when phenomena can be traced up to their determinate laws, or in other words (agreeably to what has been above maintained), to their *physical causes*, then, and then alone, it is, that we can ascend to the idea of a regulating *moral cause;* and deduce the conclusion of superintending volition and designing intelligence.

In general then, the evidence and stamp of moral agency and intelligent influence, is found in the discovery of a *uniform consistency* in the results, in a regular arrangement of parts adapted to each other, and to the whole, such as to preclude at once the idea of caprice and chance, and that of blind unforeseeing fatality. And this may be distinguished into two kinds:—1st. Where a fixed end is discoverable, and we observe the direction of means to it, and changes taking place in furtherance of it. 2nd. Where, although no such end is discoverable, and no change takes place, yet we perceive things arranged in a certain invariable order and symmetry.

In the study of the actual laws, mechanism, and arrangement of the natural world, we have a magnificent field open before us, in which to pursue the inquiry, whether such indications of moral causation can be traced; and this inquiry is in fact, in its most essential point, already answered in the conclusions at which we arrive by inductive science, the universal order and invariable harmony pervading the material universe.

The application of the truths disclosed by the study of the laws of nature, and the dependence of physical causes, is, indeed, not to be mistaken; and it may be truly said, that the sublime conclusions of natural theology, in their general and popular acceptation, are obvious on the most cursory survey of the natural world, and at once convincing, even to the most uninstructed apprehension. Unless miserably blinded by prejudice, or incapacitated by moral perversion, the most untaught mind instantly recognises the evidences of the Divine existence and attributes, and unhesitatingly regards the visible order and adaptations of the natural world, as no other than the created manifestations of the Divine perfections. Let us, however, observe that the special object of natural theology, *as a science*, is to analyse the *precise steps* by which these conclusions are attained, and examine the security of the ground on which they rest. The preceding portion of this inquiry has been directed in its proper way, towards this object, by scrutinizing the more general grounds on which all our ideas of the relation of effects to their causes depend; and it is to the more particular application of these views to the great argument of natural theology that we are now to proceed.

### *Nature of Final Causes.*

At the outset of this inquiry, we meet with an expression very commonly employed, but often with little attention to accuracy of meaning; the consideration of what are called "*final causes*," is referred to as the main evidence afforded by the study of nature, for the existence and perfections of the Deity. Here then, as in other cases, it is to the meaning of the term that our attention must, in the first instance, be carefully directed. Now the application of the word "cause," when we speak of "final causes," is somewhat peculiar, and, in fact, such as very commonly to occasion mistake and difficulty. Yet the phrase has been perhaps too strongly sanctioned by custom to allow an expectation that it can be generally discarded, even though we should gain considerably in perspicuity, by adopting other expressions to convey the same meaning.

A few instances will serve to illustrate the use of the term:—The circulation of the blood is said to be the *final cause* of the valves in the blood vessels. It would not be considered correct language to call it the *cause* simply: though by another modification of the word, we might say that the valves are provided *because* of the circulation. We might easily illustrate the distinction by abundance of other examples, from all parts of the natural world.

The variation of the seasons is said to be the *final cause* of the obliquity of the earth's axis. The graminivorous or carnivorous constitution of animals, the *final cause* of the respective forms of their teeth and feet. The painting of the image, exactly on the retina, is the *final cause* for the lens of the eye having precisely that focal length, and the medium a corresponding refracting power. Whilst the formation of an image, free from colour (in perfect eyes), is the *final cause* of the lens and vitreous humour having their dispersive powers in a certain relation to each, by which, in theory, that condition will be secured*.

In all such instances we, in fact, use a very circuitous mode of expression in adopting the term "final cause." It was remarked before, that in ordinary language we often use the term "cause" to signify the reason, object, or motive, influencing some moral or intelligent agent. Now when we consider the *end* or *design*, in order to which, one thing is arranged in a certain adjustment to another:—when we observe things so adjusted to each other as to be able to trace manifest indications of such plan, then we say of two things so adjusted, that the one is the reason for the other; that the first arrangement was made with a view to the second, or that the second is the *use, end, final reason,* or lastly, *final cause,* of the other. We mean, then, a *cause* operating not in one arrangement upon the other, (as physical cause and effect,) to produce it, or even to regulate it, but in the *motive* or *reason* of the intelligent agent, who, we infer, contrived and *designed* the adjustment.

Thus the term "final cause†" really implies no more than is implied by the term "design." In the first instance, we find, as mere matter of fact and observation in the order of nature, a recondite adaptation, or fitness, of all the parts of organized beings, and of all the functions of unorganized matter, to each other. We observe that every natural arrangement has its relations to other arrangements: that every physical effect has its dependencies, its uses, its purposes, in reference to others. We discover that in every such relation, (so universally and immutably preserved,) some particular *end* is, in fact, answered, some particular object secured. It is from the notice and conviction of this bare matter of fact, that we are *led on to the further idea and belief* of design and intention: that the end which we see answered was contemplated, that the object which we see attained was designed *.

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* See Note D.

† The etymology is illustrated by the expression of Crellius: "Res hujus universi omnes *finis gratiâ* existere."—*De Deo et ejus Attrib.* c. iii.

There is, however, another sense in which the same term "final cause" has been used by some writers, which it is worth while to consider, more especially as the confusion thus introduced has led to serious misapprehension of their opinions.

In some cases we may trace the dependence of a phenomenon through a series of physical causes; and the last, highest, or *ultimate*, cause to which we can thus refer, has been sometimes called the "*final* cause." And where men have been unable or unwilling to investigate such proximate physical causes, they have been prone to refer at once, as an ultimate or "final" cause, to the will of the Deity; and to resolve the whole into an immediate effect of the Divine interposition. We shall have occasion to recur to some instances of this sort in the sequel; for the present, the following passage from an eminent philosopher will sufficiently exemplify the case:—

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* See Note E.

Laplace observes,

"Tous les événements, ceux même qui par leur petitesse, semblent ne pas tenir aux grandes lois de la nature, en sont une suite aussi nécessaire que les révolutions du soleil. Dans l'ignorance des liens qui les unissent au systéme entier de l'univers, *on les a fait dépendre des causes finales*, ou du hasard; mais ces causes imaginaires ont été successivement reculées avec les bornes de nos connaissances, et disparaissent entiérement devant la saine philosophie qui ne voit en elles, que l'expression de l'ignorance où nous sommes des véritables causes*."

From this passage it is manifest that the author uses the term "final cause," simply in the sense of "arbitrary agency," or "direct intervention:" or, in other words, employs the term "final" as equivalent to "ultimate."

To add another remark:

The inquiry into final causes may fairly call for the exercise of much caution in distinguishing *real* cases of adaptation from many which are but *apparent* and fanciful. Far-fetched and overstrained instances of this kind are sometimes urged where no real or substantial indications of design can be rationally admitted. And those who are bent on finding such evidences everywhere, are too apt hastily to decide that one result was actually ordained with a special view to another, where the connexion is too remote to allow us reasonably to consider it so. Such a course is apt to produce no other result than that of exposing to reproach the whole investigation of final causes. And the judicious inquirer will perceive at once the injury done to the truth by weak and delusive arguments adduced in its support, and how little need there is for such doubtful aid in the abundance of substantial evidences with which we are surrounded.

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* *Essai Philosophique sur les Probabilités*, p. 2.

### *Use of Final Causes in Science.*

The only case in which there can be any reasonable ground for dispute about the use of terms, is where they may be so chosen as to lead to ambiguity or mistake, as to the ideas for which they stand.

Now much discussion has arisen as to the investigation of final causes; and, especially, whether the study of them be a legitimate part of the province of natural philosophy. But all dispute may, I conceive, be avoided, simply by attention to the precise meaning of the term.

According to what was above observed, we certainly *may* agree to use the term "final cause" as simply equivalent to describing the *fact* of the *adjustment* which we actually observe. Our meaning will then be totally free from all ambiguity. But then, this is only an inconvenient and circuitous way of expressing what would be more clearly and simply described by the plainer terms, "fitness," "arrangement," "adaptation," of things to each other.

On these grounds I agree, therefore, with those who prefer to discard altogether the use of the term "final cause," and to employ in its stead only the plain terms "adjustment," &c., which express the facts we actually observe or inductively collect.

We should thus be relieved from all controversy about the introduction of final causes in natural philosophy. Since no dispute exists as to the propriety, nay necessity, of considering those adaptations and arrangements in our physical inquiries which are in a great measure forced on our observation, and without which our researches would be miserably defective in their most valuable, instructive, and important results.

In regard to the reasoning, we should thus escape all danger of perplexing (even in appearance) the order and chain of it; which is often greatly entangled by the mere introduction of an ambiguous term. By adhering to these more simple and perspicuous modes of expression, we should more palpably preserve that distinctness of meaning in form, which, at all events, must be preserved in substance. We shall keep clear the *inferences* from the order of physical causes, and the study of the causes *themselves:* in other words, we shall not confound *physical causes* with *moral agency;* but shall be prepared, in the only sound and legitimate way, to deduce the indications of the latter from the former.

The term "final cause," employed in the sense at first explained, as that which it must in strictness bear; viz., as involving a reference to the processes of creative intelligence; is doubtless most improperly introduced into the investigation by which we advance to the elementary truths of natural philosophy. And manifestly for this reason, that it expresses, and thus misleads us into making the *assumption* of the very thing which it ought to be our object to *prove* from the truths elicited by natural science; viz., the existence of creative intelligence, of an omnipotent and omniscient Creator.

But it has been contended that the study of "final causes" may be, and has been, of important use in physical discovery: and the well-known example is adduced of the discovery of the circulation of the blood by Harvey, in consequence of a reflection into which he was led on the probable *use* of the valves in the veins.

Let us keep to unambiguous terms, and the case merely shows that a good conjecture, derived from the *observed fitness* of the valves for such an office as would be discharged by them, *if* the circulation were a fact, led him to the *right train of analogy,* which he so completely verified by observation. In this way it is often the case in the researches of the naturalist, that from observing the obvious purpose of some one organ, he is able to conjecture the probable *use* of some other, which, but for such analogy, would be totally obscure; and such conjectures, if well founded, seldom fail to be borne out by actual experimental proof.

The *uses* of things (simply so considered,) wherever they have been fairly traced and established, supply a perfectly just, and most useful ground of analogy for guiding us to inductive conclusions. The habit of observing such adaptations in actual cases suggests grounds of reasonable probability for expecting them in instances as yet untried; and such *conjectures* in skilful hands are of the utmost utility in physical inquiries; as we often noticed, in the course of our former illustrations.

So long, then, as we confine ourselves to the simple notion of the *fact* of *adjustment*, or *use*, without reference to moral or intellectual causation, we are not departing from sound *physical analogies*, which we have before contended are the only rational guides in those conjectures which lead to sound inductions.

### *The Economy of Causes.*

Another instance of the use of final causes in physical investigation, on which much stress has been sometimes laid, is the reference to what has been called the "lex parsimoniæ," the "economy of causes," or the principle that "nature does nothing in vain;" or that the most simple means are always adopted for obtaining given ends; or that several powers or agents are never resorted to where one suffices. Such a principle finds its use and application in aid of scientific research, when it is taken as a guide to the more simple in preference to the more complex theory; to known causes rather than imaginary; to hypotheses already applying in other cases rather than new and arbitrary ones; to analogies with existing and established relations rather than to gratuitous suppositions.

Of this kind were the arguments from probability, which weighed most with Copernicus and with Galileo, in favour of the solar system, at a period when no demonstration had been attained; and a more precise exemplification has been found in the argument for the earth's motion in its orbit, and its rotation on its axis, being derived from one and the same primary impulse. It having being shown by Bernouilli, on mechanical principles, that one impulse would produce both, and even the precise point of the earth calculated at which it must have been applied, so as to accord with the existing motions and velocities.

Upon this I will merely observe that the principle referred to, when stated in simple and precise terms, is, in fact, nothing more than the announcement of a great physical and inductive law, the evidence for which is no other than that of any other physical induction. It is, however, highly important in our mode of enunciating it, to keep it carefully distinct, as an inductive conclusion, from all manner of speculative assumptions. For (precisely as we have noticed in other cases) it is in this way alone that we can consistently and rationally employ any guide to scientific conclusions, when those very conclusions are to form the *evidence* of the truths of natural theology. For the legitimate force of such arguments, it is manifestly essential that we avoid making them arguments in a circle; and that we do not *assume* the operation of the Divine will in the process of reasoning by which we seek to *prove* the operation of the Divine will.

### *Final Causes in Comparative Physiology.*

THE question respecting the introduction of final causes into philosophy has been made peculiarly prominent in the controversy which has subsisted between two distinguished schools of physiology in France, to whose general views of organization we have already adverted*. The question with regard to final causes has, in fact, been mixed up with the purely physiological question at issue between them, from which it undoubtedly is quite distinct, and ought, especially in an inquiry like the present, to be carefully kept so. In the views which have been taken of this controversy, we may also observe that the *tendency* ascribed to the respective opinions has had a considerable share in influencing the judgment formed upon them; and has, perhaps, assisted in obscuring their real character; which, when dispassionately examined, seems to me by no means such as to justify the strong censure of the one and preference of the other, which has been sometimes expressed.

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* See Whewell's *History of the Inductive Sciences*, vol. iii. p. 456, *et seq.;* and above, p. 39.

Cuvier and his followers have insisted strongly on the propriety of pursuing physiological examination upon the assumption, that every part of the organization of an animal must have *some use*, and that then by comparison of one part with another, we should proceed to trace *the particular use* and intention of each organ, and so advance to our conclusion as to the nature of the animal, and its place in the scale of creation. Cuvier specifically states this principle of what he terms "the conditions of existence," as equivalent to what are commonly called "final causes;" and speaks of the combination of organs adapted to "the part which the animal *has to play* in nature." And in affirming this, Cuvier has but extended and followed up the method of the most distinguished of his predecessors, who have generally regarded this adaptation of parts in organized structures as not only an inference deduced from all researches, but a sure guide in further investigations.

To these views the advocates of theory of "unity of composition," or "analogues," have been strongly opposed. Geoffroy St. Hilaire, while he confesses that "it is very difficult for the most cautious man never to have recourse to final causes in his explanations," yet agrees with Bacon in considering them as "sterile;" and expressly observes, "I take care not to ascribe *any intention* to God; for I mistrust the feeble powers of my reason. I observe facts merely, and go no further. I only pretend to the character of the historian of *what* IS. I cannot make nature an intelligent agent who does nothing in vain, who acts by the shortest mode, who does all for the best*." And again remarks upon the before-quoted expression of Cuvier, "I know nothing of animals who *have to play* a part in nature†." He has also illustrated his ideas still further by the remark, that when it is stated, for example, that fishes have certain locomotive powers *because* they are destined to live in the water, "by the same reasoning you would say of a man who makes use of crutches, that he was originally destined to the misfortune of having a leg paralyzed or amputated."

Let us merely, in these cases, as in others, look to the correctness of our reasoning, if we be really aiming at a sound analysis of the evidences of truth. Let us but guard against the manifest error of taking for granted the thing to be proved. If in physiological, as in any other inquiry, we set out by *assuming* design, intention, or in a word, a *moral cause*, then it is clear that any *inference* we may wish to draw in support of the truth of natural theology, is vitiated and nullified. Considered, therefore, as taken in the correct order of reasoning, the caution expressed by Geoffroy St. Hilaire, appears to me strictly just, and the censure which has been cast upon it undeserved. If he did *set out* by "ascribing intention to the Deity," he *could not* arrive at any *proof* of such intention. The *reason*, indeed, which he assigns of "mistrusting his feeble powers," appears to me to be a wrong one; it should rather be that *all reasoning* would thus be lost, and all its steps confounded together. But as a physiologist, as supplying the materials for the conclusions of natural theology, he is undoubtedly right in assuming solely the character of the *historian*, and seeking only bare facts and laws, that he may *from them* elicit the great inferences to which they lead. To assume the "economy" of causes, to "make nature an intelligent agent" in the outset, would be to anticipate the conclusion; if the idea itself do nof involve an entire confusion of thought. To assign to animals "a part to play" before we have traced their analogies, is surely premature in the order ot just reasoning, if by that expression anything more be meant than the mere guiding conjecture which the structure of their organs may suggest.

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* *Principes de Philosophie Zoologique*, p. 10. † Ib. p. 65.

It is equally true that the habit of making such assumptions, even tacitly, is *difficult to avoid.* Because when proofs have already largely accumulated, we are of course prepossessed with the conclusion which we suppose the further instances must also substantiate. But when our avowed object is the exact discrimination of *evidence* as such, and the strict analysis of our impressions into their logical elements, the distinctions must be studiously kept in view.

The illustration of the man on crutches has been blamed as idle and unbecoming. It does not appear to me deserving of censure in this way, though I think it *inapplicable,* as being an argument upon an isolated and accidental case; the essence of such reasoning consists in its extension to entire species and classes of beings in their natural relations. At all events, whatever may be thought of the particular illustration, the same remark must be still applied with regard to any *assumption* of designing moral agency in the adaptation.

Let us, in such reasoning, only bear in mind these obvious distinctions. Let us not allow physical investigation to borrow from natural theology, if it is to furnish the very means of support to divine truth. Let not natural theology be made to minister to science, if science is to be the handmaid to natural theology.

In physical laws we must keep clear of assuming *moral* causation. But the general laws and analogies *already* established may fairly be taken as our guides to others yet to be made out. They, indeed, *must* be so appealed to; for, as we endeavoured to show at the outset, they are recognised, and bear an essential part, even in the strictest logical analysis of inductive reasoning*.

In the particular instance, then, of the physiological topics referred to, we may fairly adopt (as the evidence may seem to warrant,) either the principle of " analogues," or of the "use of organs," (this latter being carefully distinguished in meaning from any idea of *moral causation.*) But these or other equivalent physiological theories must be taken simply as such, and barely as far as they are warranted by inductive laws; and in this way they may be most correctly adopted, and even become indispensable as our guides in considering any new case, or carrying on any further research.

## *Comparison of Arguments from Order and from Mechanism.*

The examination of the question last referred to may suggest, some further reflections not unimportant with reference to the evidences of natural theology.

The two theories of comparative physiology to which we have been referring, and which have been considered as so much opposed, especially in their bearing upon the conclusions of natural theology, do not, upon closer examination, appear to present anything really at variance. Without pretending to form an opinion on their respective merits, considered physiologically, I will merely observe this much: Both systems tend equally to establish the existence of profoundly adjusted order and uniformity in nature, though of somewhat different kinds. The one system contemplates the entire range of animated beings, and unveils to the well-directed eye of the physiologist the most marvellous preservation of exact analogy, even throughout the most apparently trackless mazes of dissimilarity. The other, without taking this wide range, yet establishes the same truth, within more limited and detached portions of the field of inquiry, and within those several limited portions enlarges greatly our perception of the combination of adjustments in which the same great principles are manifested.

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* See Section I., page 25, and note.

The one theory dwells on the relations and adaptations of whole classes and orders of animated structures to each other; the other, on the relations and adaptations of the several parts of one animated structure to each other, and to the purpose of the preservation and well-being of the whole. The one leads us to consider the more abstract analogies which connect together the various parts of animated nature by general laws; the other, the more practical relations and mutual subserviency of the parts of organic structures to the purposes of animal existence. The one shows a vast and perfect composition, an elaborate and systematic design, presented to our contemplation; the other, a profoundly ingenious and complicated machine set in action.

Now, if we consider the bearing of these views on natural theology, it must, I think, be admitted that they both, though in somewhat different ways, tend equally to substantiate the great inference of *design*. In the universal preservation of systematic order, susceptible of exact classification by pervading analogies, there is just the same indication of *design* and *intelligence* as in the adaptation and adjustment of the parts of any individual machinery to an end.

An elaborate design of art, a well-proportioned edifice, a magnificent painting, though addressing themselves solely to our contemplation in their silent and immovable proportions, are surely quite as forcible manifestations of intellect and genius, as the most skilfully contrived piece of machinery in incessant activity, fabricating the most useful productions.

Either way, then, in the study of nature there is an equally clear manifestation of that infinite intelligence, which, after the inductive examination of the laws or adjustments in either case, we are directly led to acknowledge as the irresistible conclusion. And as this is the case with either species of investigation singly, so will it be more pre-eminently true when both are pursued jointly, as they assuredly may be, without the smallest detriment to each other, or confusion of first principles, provided only we keep strictly to the simplest rule of all just reasoning, and do not confound our final conclusion with our first assumption.

The highest philosophy is most disposed to cherish a readiness to perceive and admit the fair indications of design and intelligence, in whatever form they may present themselves; and there is a wider expansion given to our views when we thus include the contemplation of order and symmetry, (even though we perceive not their end or object,) in our notion of design. In such considerations we may find the loftiest exercise of truly philosophical reflections; we shall realize the highest aim of scientific speculation; and shall recognise the truth of the remark so forcibly expressed by Dugald Stewart:—"There is a certain character, or *style* (if I may use the expression,) in the operations of Divine Wisdom; something which everywhere announces, amidst an infinite variety of detail, an inimitable unity and harmony of design; and in the perception of which *philosophical sagacity and genius* seem chiefly to consist*."

## *Example:—Botanical Symmetry.*

THERE are few branches of science from which we learn more decisive indications of that wonderful symmetry and order which exist in the disposition and modification of organized structures, than from botany.

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* *Philosophy of Mind*, ii. 418.

In the classification of plants alone, whether on an artificial or a natural system, we trace the clearest indications of this pervading principle. But so little is the bearing of it perceived, that nothing is more common than to hear ridicule cast on the emptiness, as it is considered, and pedantry of scientific nomenclature and systematic arrangement. Those who ignorantly indulge in this kind of censure are little able to understand how much even this mere classification implies. Had it no other use, the mere fact of an unfailing reduction of each individual and each species to its place in a system, is itself an unquestionable and obvious indication of plan and design in the organization of those individuals and species. The system may be artificial and complex, the nomenclature may seem dry, technical, and pedantic, but the existence of order is real; and the invariable adherence to a certain determined set of types and forms is nothing less than one of the most decisive evidences of that pervading uniformity throughout nature, which is the legitimate manifestation of one presiding intelligence.

But nowhere, perhaps, in the compass of this science is the truth of our position more singularly confirmed than in the remarkable fact observed by botanical physiologists, of the existence of *abortive*, yet always *symmetrical* parts in plants. The subject has been touched upon in immediate connexion with our present application of it by Dr. Daubeny, (in his inaugural lecture on botany,) and I cannot better convey an idea of it than in his own words:—

"We find parts existing in a rudimentary or abortive state in one species, which in others serve some manifestly important office; neither would it be any objection to the idea of design, if it could be proved that in this rudimentary condition they were absolutely useless, although it must be considered an additional proof of arrangement, when, as in many instances, we are able to show that they become subservient to a new purpose by being unfitted to their primary one*."

After giving some instances of these occasional transmutations of function and character) the author observes distinctly, that, apart from this, the existence of these abortive organs in a regular symmetry is alone an indication of design; and quotes in support of his view the following remarkable illustration from M. De Candolle:—

"If on a subject so grave and elevated I may be permitted to avail myself of a comparison somewhat mean and trivial, I may, perhaps, render my views on this subject somewhat better understood.

"I will suppose that I am seated at a splendid banquet, and certainly the repast which nature sets before us may well merit this appellation.

"I endeavour to discover what evidence can be afforded that this banquet is not the result of chance, but has been due to the will of an intelligent being. No doubt I should remark that each of the dishes is in itself well prepared, (this is the argument of the anatomist,) and that the selection of them implies a reference to the wants of the individuals who partake of it. This is the reasoning of the physiologist. But may I not likewise observe that the dishes that constitute this repast are arranged in a certain symmetrical order, such as is agreeable to the eye and plainly announces design and volition?

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* p. 24.

"Now, if on examining the above arrangement I should find certain dishes repeated, as for instance in double rows, for no other apparent reason than that the one might, in a manner, correspond to the other; or observe, that the places which they should occupy were filled with imitations of the real dishes, which seem of no use with reference to the object of the repast, ought I on that account to reject the idea of design?

"So far from this, I might infer from the very circumstances stated, an attention to symmetrical arrangement, and consequently the operation of intelligence.

"Now, this is precisely what happens on the great scale in nature. Considerations derived from the symmetry of parts correct, in great measure, what is deficient in the theory of final causes, and tend, not only to resolve many difficulties which present themselves in the general economy of nature, but even to transform them into evidences of the existence of this very order."

I will not injure the force and beauty of this illustration by any comment. The conclusion appears to me irresistible, that symmetry of arrangement is as decided a proof of design as adjustment of mechanism:—beauty and harmony as clear indications of mind, as combination of mechanical action.

### *Examples from Physiology.*

FEW parts of the organized body were more completely involved in obscurity as to their nature and functions than the nervous system; until of late years, by the united labours of Sir Charles Bell, M. Magendie, and Mr. Herbert Mayo, a valuable light has been shed upon the subject.

All parts of the body over which we have any control, are found to be furnished with two distinct sets of nerves. Every part has also, as we well know, two distinct powers or functions, one passive, or that of sensation: the other active, or that of voluntary motion. Of the two sets of nerves one invariably gives the first power: the other the second.

This recondite distinction of use and properties, so undeviating in the midst of the greatest apparent complexity, is surely a striking instance of the most beautiful harmony between the distribution of the organs and the corresponding functions. Though we perceive no mechanical principle of contrivance, nor (in the ordinary sense) any *reason* for the twofold system of nerves.

But these researches have been carried further: at first sight nothing would seem more devoid of order or method than the arrangement of the origins of the respective systems of nerves. Mr. H. Mayo*, however, has succeeded in reducing the apparent confusion to a simple system. He has made out the general law of distribution, that the nerves of motion have their roots in the same part or segment of the nervous centre as the corresponding and accompanying nerves of sensation.

The same physiologist has pursued the subject more recently, and has deduced many curious results, especially involving the confirmation of the profound anticipations of Dr. Whytt (1768); which are remarkable as tending to simplify and reduce to a common principle, the instances of many motions and affections, which have been regarded as involuntary; of which we seem unconscious; but which yet are really results of volition, though overlooked from habit. The consideration of probability and analogy derived from the simplicity of nature, was here the guiding principle which led the author to his inferences†; and which is so beautifully confirmed by them.

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* *Outlines of Physiology*, 4th edit. p. 263; and *On the Powers of the Roots of the Nerves*, &c., London, 1837, p. 17.

† Ibid. p. 21.

The cases last referred to afford good examples of a simplification of principle, which may be fairly urged as a proof of Presiding Intelligence in the arrangement of the organized body, though we see nothing but the indications of this symmetry and order, and no positive perception of a use or end answered. To look only to such purposes, or practical contrivances, is to take far too narrow a view of final causes. We should learn to trace design equally, perhaps even more clearly, in cases where we perceive no end or practical design, but where the influence of ordaining intelligence is displayed solely in the continually increasing simplicity of principle and symmetry of arrangement, which are constantly opening upon us in every successive advance of discovery.

It has been admirably observed by the distinguished physiologist just referred to, "As philosophy advances the properties of matter are perpetually found to be fewer and simpler; which the creative wisdom so combines and directs as to produce the most diversified, and, at first sight, opposite results*." The disclosure of such a principle alone seems to me to constitute the highest kind of proof of presiding and ordaining Intelligence. I have above referred to some instances in support of it; but I must here add one more case, which places the argument in a peculiarly striking point of view, derived from the researches of modern physiology; and which I cannot express better than in the words of the same author*:—

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* *Introductory Lecture at King's College*, 1834, p. 16.

"One common commencement is there for the development of all the families of vertebral animals. There is a period after its commencement, when the frame in outline being already distinct, the class even of the individual is indistinguishable, whether it be fish, reptile, bird, mammiferous animal, or even man. For a time, these all march parallel, alike in all things, the highest not differing from the lowest. For example: the fish, the lowest in the scale, is formed to breathe the waters; for this purpose, in its throat there must be openings made, to give passage to the water through its gills. These openings are called branchial apertures. The reptile has no need of these openings; but they are formed in it. In the bird they would serve no use; but they are there. In the mammiferous animal again, in man, they are useless, but they are still present. Respiratory apertures in the neck, with a single heart, and a corresponding distribution of the aorta, form the early undistinguished and undistinguishing type stamped on the whole range of vertebrata.

"But now a difference begins. This character of organization is to be permanent in fish. In fish, therefore, it now expands and amplifies itself. At the corresponding period, in the higher animals, it fades and disappears; shrinking, while a higher order of organization supersedes it, and parts are developed which in the fish appear not. This law holds throughout the economy. There is one common type for the brain at its first production, which remains permanent in the lowest tribes, but is improved upon by fresh developments in each above. Thus the brain of man at first resembles that of a fish, then of a reptile and bird: finally, it becomes the mammiferous brain, then human."

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* Ibid. p. 20.

On contemplating so truly astonishing a train of development as is here unfolded, the reflection which presents itself to the mind may, in the first instance, be very different from that which is induced on a more enlarged consideration of the case.

In the gradual stages of the process here unveiled, we perceive organs bestowed apparently without discrimination as to the future destiny of the creature: adapted in many to no perceptible end; in fact, positively useless and superfluous. All notion of final causes *seems* excluded; and all idea of adjustment to a purpose, violated. Even the suppression of a useless organ, and the substitution or super-induction of one which is useful, seems a circuitous and unnecessarily complex process of obtaining the end ultimately accomplished.

But when we look at the *regularity of the system* on which all this is planned; when we consider that these useless or abortive organs are, in all cases, constructed on one simple model; when we observe the precise order in which they disappear, exactly in accordance with the destined difference of function in the different species; when we trace the undeviating scheme on which the new modifications are respectively super-induced; when we regard the determinate scale, according to which the whole process is unalterably carried on;—then we shall be urged with an increasing and accumulating force of conviction, to the conclusion that all this arrangement, however apparently complex, is, in reality, an astonishing instance of conformity to laws of the most recondite simplicity: that every step in the process, however apparently superfluous, is in strict accordance with a great principle of uniformity: that every stage in the transformation, however, in first appearance, destitute of direction to a purpose of utility, yet, if it answer no other, has its direct application in filling up a place in the universal harmony and incomparable unity of design, which pervades all organized nature. The very singularity of the provision, well considered, evinces the enlarged preservation of analogy: the very objection and difficulty of the case is converted into an evidence in favour of the argument from symmetry.

But this is not all: an extension of the same principle, nearly obvious when once it has been made known, enables us entirely to refute one of the most plausible objections, and remove one of the most formidable difficulties, which previously opposed itself as a positive exception to the harmony of design in the animal organization; the existence of cases of malformation. These are now understood, by the aid of the principle just adverted to, to be in fact, due not to any disordering interruption, not to any anomalous interfering cause, but simply to a deficiency in power to carry on the process of development; which is therefore merely arrested at an imperfect stage*.

### *Proximate Causes compared with Fixed Laws.*

THE distinction which has been before drawn between physical and moral causation, and the relation of cause and effect, may tend, in no small degree, to remove a difficulty sometimes felt in the estimate of the proofs of creative wisdom and power supplied by the contemplation of organized life as compared with those derived from the study of the heavenly bodies. In the former case, the production of animal and vegetable life is observed to be always in connexion with a proximate material *cause.* In the latter we can conceive no material cause of the existence and motions of the planetary system. Hence it has been noticed that the former class of phenomena do not furnish (to some minds at least,) the same conclusive evidence of a Deity as the latter *.

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* For an explanation of these cases (of which my limits will not allow the insertion,) the reader is referred to the same *Introductory Lecture*, p. 21.

Now when the nature of physical or material causes is distinctly understood according to the view we have here taken of it, it becomes evident that the material or physical agency which is referred to in the production of organized life, is nothing more than the series of laws to which we are able to reduce those processes of nature. We trace an invariable course of sequence and dependence of one phenomenon or effect, upon another of a more general kind. We can follow up these trains of consequence through a considerable number of steps, and thus perceive a connected series of laws impressed upon the functions of material and organized beings. In the case of the heavenly bodies we cannot do this, at least with reference to the origination of their motions, or adjustment of their masses and distances. The difference, then, is solely that we can trace a longer series and a more complicated system of physical laws in the one case than in the other; and therein it would seem to follow a greater rather than a less manifestation of design and intelligence in the former case. In neither do we arrive at any *efficient* causation or moral agency but by carefully establishing the material indications of it; and it is solely from the adjustment of physical laws that we are able to trace those indications. The material proximate causes (as they are termed,) of the production of organized life are causes of a different *kind* from that moral causation which, in the imposition of laws on matter, and in calling that matter into its existing combinations, we recognise as creative power.

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* See Dr. Turton's *Natural Theology*, p. 54.

### *Evidences of Creation.*

JUST and sober inductive science, applied to the examination of the actual structure of the earth's crust, enables us with satisfaction and certainty to trace the changes which have taken place on the surface of a globe possessing the same nature as the existing earth, and in the structure and habits of organized beings *analogous* to those now inhabiting the world. It investigates the alterations which have been effected by physical agents resembling those now in operation, and in accordance with general laws the same as those now recognised in the economy of nature.

But it does not, and cannot rise to the disclosure of what occurred under a *different state of things*, or owing to the action of causes of a different order from those now discovered by physical research. It cannot show a chaos, or trace the evolution of a world out of it. It cannot reason upon a supposed state of universal confusion and ruin, and the immediate reduction of it into order and arrangement.

It can investigate the changes of things, but not their origin; in a word, sound geology will never aspire to the character of cosmogony.

Geology is, indeed, pre-eminently distinguished from other branches of physical science in this, that while they teach us only the *existing* order of nature, this carries us back in time, and shows a period when the present races of organized beings did not exist; and by consequence, establishes the fact of a creation, that is, more properly, of a series of creations; and these manifestly not brought about at any one marked period, or extending to all animated nature at once, but by the slow and gradual introduction of each new species as the older disappeared.

The successive strata are the sepulchres of successive races of organized beings, differing more or less from existing species; and those of the least antiquity containing extinct species, co-existent with those now tenanting the globe, and bearing decisive evidences of progressive, local, gradual deposition and elevation. The marks of sudden violence, indeed, are occasionally seen in all formations; but their occurrence is the exception, not the rule; and in its most extreme cases, always limited to a narrow *local* extent. No one simultaneous universal change has ever taken place on the surface of the globe; but all effects, however great, have been accomplished by a series of local and partial changes; and even where we may be left to conjecture as to the violence or suddenness of those changes with respect to *time*, we have ocular proof of their extent in *space*. All that geology establishes, then, in this particular, is the fact of the gradual origination of new species, but by no means the particular method or process by which it has been brought about.

It is true there have not been wanting theories to explain these processes on natural principles. Yet of these, the most celebrated have failed to stand the test of increasing observation; while none, perhaps, have been altogether satisfactory or free from material objections. Physical research cannot bring us to any distinct idea of the nature of creation. If we consider the simple case of the introduction of a single new species, or even individual of a *new* species, there is an obvious limit imposed on our speculations. On the other hand, it is freely open to the physical inquirer to trace, as closely as possible, the *secondary means*, as far as the nature of the case admits; to investigate rigorously, for example, all the modifications which change of climate, domestication, crossing of breeds, &c., may produce. Such inquiries may be far from successful; they may lead only to some few imperfect conclusions utterly insufficient to ground any theory upon; but certainly this is the only course open to the inductive inquirer.

The question respecting the immutability of species, and the possibility of a transition from one into another; of such modifications as we observe in intermediate races being perpetuated; of new species being thus eventually introduced; with the various collateral topics which are involved in these inquiries, have all formed the subjects of anxious debate, and even of animated controversy, among physiologists. There has undoubtedly been a preponderance of evidence against the notion; and the high authority of Cuvier has been claimed as heading the phalanx of the opponents. Whilst on the other hand, Geoffroy St. Hilaire has spoken of the "age of Cuvier" as approaching its termination, and the immutability of species as a conviction fast fading away from men's minds. All that I presume to observe on such a subject is this: that it is a question fairly open to philosophical discussion; and one which is at any rate the only avenue to a scientific solution of the problem. If natural science be ever able to conduct us to the knowledge of such a point, it must be by some such route as this. And we have no more reason to despair of its doing so in this case than in any of the other instances of philosophical discovery, which in a past age might have been pronounced as hopeless and visionary as some are now disposed to consider this. While we must also recollect that all the conclusions which have been deduced from the observed facts relating to the modifications of species are restricted by the condition of the short period of time during which their operation has been contemplated; and that we must admit as essentially influential the very different circumstances which might affect similar operations continued through unlimited periods of past duration.

The appeal to another kind of evidence, to knowledge derived from another source than that of physical inquiry conducted on the principles of established natural analogies, would merely transfer our inquiry out of the pale of physical science into that of moral authority, and would consequently divest it of all force in respect to the purpose of substantiating the great truths of natural theology. The proper conclusions of physical inquiry are to be directed only to the two simple points, the actual occurrence of successive originations of species, and the elucidation, as far as possible, of the secondary means by which those originations may have been brought about.

Geology, then, affords abundant proof of the fact that there was a time when the present races of organized beings did not exist, and consequently bears direct testimony to the occurrence of what we term creation; that is, the introduction of new species; as it does also of the previous introduction of a vast series of other species, of which it also shows the successive extinction. But the evidence is perfectly clear as to the *gradual* character of this introduction of species. Those now existing are found to have co-existed with others now extinct, as these did in their turn with those of older date, until we arrive at periods when whole genera and classes were entirely different. But at no period do we find an absence of organized life followed by a simultaneous universal production of it.

When, therefore, on geological grounds, we speak of the evidence of creation, we must carefully bear in mind what is meant, and must restrict our meaning to the gradual appearance of one increasing family, while another was as gradually wasting away and disappearing. Geology, in a word, bears witness to a continued, perhaps perpetual successions of creations. It consequently tends infinitely to exalt our ideas of that eternal and overruling Omnipotence by whose agency they were brought about.

But no researches have disclosed the *mode* in which this has taken place, nor the process by which such a result of creative Omnipotence has been accomplished. It only assures us that it was not applied to all existing species at any one time. While, therefore, geology has been unable to trace the *mode* of the Divine operations, it has, beyond all question, substantiated the *fact* of such creative processes. And the leading truth of this gradual progress of the development of the varieties of organized life corresponding with changes in the disposition of the solid materials of the earth's surface, and of the temperature and climate, is perhaps among the most striking and beautiful points of evidence which geology affords to the conclusions of natural theology*.

Few truths are more impressive and sublime than this unbroken continuance of uniform laws and harmonious adaptation to which geology bears testimony, existing throughout all the vast series of the successive orders of organized beings which have tenanted the globe, which, while it exhibits the greatest diversity in the forms of life and structure which have prevailed at different remote epochs, yet shows every where the preservation of the same most perfect harmony and analogy through periods of incalculable duration. And it is to be particularly observed how essential to this argument is the fact (before dwelt upon,) that all this was absolutely *uninterrupted* by any period of anarchy, by the occurrence of any general ruin or disorganization, by the intervention of any epoch at which the traces of organization were obliterated, or defaced, or disturbed, or at which, at least, a large part of the earth's surface was not teeming with animation, and richly furnished with all the accessories of life and enjoyment.

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* For a full illustration of this point it is almost superfluous to refer the reader to Dr. Buckland's *Bridgewater Treatise*.

Remarks similar to those just made on the idea of *creation*, will in fact apply with considerable force to the entire argument of natural theology. Natural science can exhibit to us nothing but a series of physical causation; from this we infer design, that is, moral causation. But no such deduction can ever guide us to the discovery of the *mode* of operation, or enable us to trace the method by which the supreme volition executed its designs, or to supply the connecting link between physical and moral causation.

### *Fixed Laws the Proofs of Design.*

The last remark leads us naturally to a more extended view of the evidence derived from the actual prevalence, so far as we can trace it, of one fixed system of physical laws.

We have already observed the importance of the testimony which all science gives to the invariable order and constant uniformity of the laws of the material world. From what we know, observe, and calculate, we are led to the inference of the perpetual and universal maintainance of this principle; and it is upon the security of it that analogy becomes a safe guide in cases beyond the limits of actual experience.

This grand conclusion forms the solid basis on which we rest our convictions of the immutability of the Divine attributes and counsels. And this is, perhaps, of all others the reflection which, to a thinking and philosophic inquirer, tends most to exalt his ideas of the Divine perfections,—the regulation of all the varied and complicated actions of the material world by an unvarying system; the combination of a limited number of first principles producing all the variety and harmony of the creation; the sufficiency of a few simple laws to regulate the entire complexity of the vast mechanism; the first constitution of the world upon a principle which, without further interposition, contains within itself the means of perpetual renovation and stability.

Now, this conclusion rests (as we have said,) on the collective inferences of a real maintainance of inviolable order in the material world. It is evident, then, that any event occurring to interrupt the preservation of this order would be a serious exception and formidable difficulty in the way of our conclusion.

The only escape from it would be in supposing that the violation of order was only apparent and not real; that though seeming an exception, it was, in truth, not contrary to the rule,—though the rule in all its extent was unknown to us; that the circumstance, apparently anomalous, was still in accordance with some recondite system unperceived by us; that our view of the real law was not yet sufficiently extensive or complete. Our only course would then be to retrace our steps, and attempt the inquiry again on better grounds.

For once imagine that real design and a determinate law are not *somewhere* preserved, and we are involved in the anarchy of chaos and the darkness of atheism; or suppose that it is not traceable by us, and *so far* to us the proofs are defective; or admit the notion of the enthusiast that all physical conclusions of this sort are the mere offspring of proud and overweening human reason, and we are idolators worshipping a Deity who is the creature of our own imagination.

It may be desirable, therefore, to recur for a moment to the consideration of inductive laws in general.

Of the extent to which that regularity may be consistent with occasional apparent anomaly, it is, perhaps, impossible to convey an adequate idea without referring to those astonishing instances which are afforded by mathematical formulas. But some illustrations of this kind are put in a very luminous and popular form by Mr. Babbage in a work already referred to. It is, for example, possible, in his calculating machine, to make such an adjustment that a series of numbers shall be produced in succession which are all complete squares; at, a certain point, one number shall occur which is a cube; after this, the square numbers shall be resumed, and continue without limit. This exception might be deemed an anomaly, an interruption of the law imposed; but it is really a part and consequence of it. Indeed, the analytical mathematician can produce many instances of formulas which give rise to a series of quantities apparently following a certain regular order, but at particular points interrupted as it were; yet again resumed and continued; which are called 'discontinuous functions.' The original principle is in these cases more comprehensive than we should be led to suppose from a limited contemplation of its results*."

The reflecting inquirer will perceive the value of such illustrations in guiding his views of the order of the natural world. Events apparently anomalous, and seeming like absolute interruptions of uniformity, may be only so because we have not attained a sufficiently extended view of the entire system to which they really are united as essential and harmonious parts.

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* See Babbage's *Ninth Bridgewater Treatise*, p. 59 (*note*,) and 95.

And such considerations become of more special importance in reference to those sublime conclusions of natural theology to which we have just before referred. Those who admit them *in general* may not be prepared to perceive the full extent to which they hold good. Yet the consideration of apparent exceptions and seeming contradictions, and suggestions, by which to resolve the difficulties, are surely most important for vindicating our belief in an eternal Providence.

### *Examples:—Gravitation.*

LET us take as an example the system of universal gravitation. Newton, by establishing the observance of unvarying laws throughout the solar system as the necessary results of one grand principle, in fact established the only evidence we can attain of the Divine Intelligence ordaining and maintaining that system; the unaltered preservation of such laws, once imposed, being the secondary means in which alone we can recognise the operation of Divine power. Prior to these discoveries we might have imagined immediate arbitrary intervention in every motion of the planetary bodies. And in any department of physical inquiry the same remark would apply. In the one case we might *imagine* such agency, but we could have no rational proof of it; in the other alone do we arrive at the sole means of proof of which our limited powers are capable.

Such has ever been the progress of physical science in all its departments; from confusion to order; from arbitrary influence to systematic arrangement; from capricious agency to overruling intelligence.

These remarks will prepare the reader to take in its correct sense an observation of Laplace, which has been much dwelt upon, and, as I think, unhappily misunderstood; owing, in no small degree, to that ambiguity which we before noticed in the use of the words "final cause;" and which, in the sentence about to be quoted, are obviously employed as equivalent to the words "direct intervention."

"Let us," says Laplace, "run over the history of the progress of the human mind and its errors; we shall perpetually see 'final causes' pushed away to the bounds of its knowledge. These causes, which Newton removed to the limits of the solar system, were not long ago conceived to obtain in the atmosphere, and employed in explaining meteors; they are, therefore, in the eyes of the philosopher nothing more than the expression of the ignorance in which we are of the real causes."

After what has been said, it will be superfluous to offer further comment on this passage, the tendency of which, when rightly understood, is manifestly so far from hostile to the true doctrine of final causes, that it points directly to those profoundly adjusted arrangements which constitute the very soundest proofs of Divine Intelligence pervading the system of the universe.

### *Perturbations:—Stability of the System.*

NEWTON developed in the most complete and satisfactory manner all the grander features of the system of universal gravitation. To that great principle, simple indeed in its law, but wholly mysterious in its nature and mode of operation, he successfully referred all the more palpable and conspicuous motions of the heavenly bodies. Here was, in truth, a physical cause of the most universal efficiency, but one which he was peculiarly careful to insist on, in the sole sense of an universal *fact* or *law;*—the tendency of all matter to fall together with a force proportional directly to the mass and inversely to the square of the distance. To this physical cause, then, he was able to trace all the greater phenomena of the solar system.

But it was confessedly the fact that there existed some slight irregularities in the motions of the planets; and it was even a consequence of gravitation that they must act one on another, in a very complicated manner, in consequence of their perpetually varying relative positions, and thus disturb the perfect regularity of each other's motion. The investigation of those perturbations was not followed up by Newton. He was aware of their existence, and that they were but small in amount, and always allowed for them in speaking of the exactness with which the law of elliptic orbits prevails. He conceived, however, that these "inconsiderable irregularities which may have arisen from the mutual actions of comets and planets upon one another, will be apt to increase, till this system wants a reformation*."

This remark occurs in a passage where he is expressly speaking of the order and harmony of the system as an indication of design. He had also before said, that "the main business of natural philosophy is to deduce causes from effects till we come to the very first cause, which certainly is not mechanical†." And again, that from observing the order of the visible world, and so inferring creative intelligence, "it is unphilosophical to seek for any other origin of the world, or to pretend that it might arise out of a chaos by the mere laws of nature; though being once formed it may continue by those laws for many ages‡."

The observation first quoted has, in conjunction with these last, been viewed as expressing Newton's belief that the adjustments of the planetary system would need renewal from time to time by the immediate interposition of Divine power. And this was looked upon by many as one of the most valuable inferences from the Newtonian system. From a reference to the passage, it will be seen at once that Newton does not himself expressly make the inference; nor, when carefully considered, is it one of any peculiar importance or force. It is difficult to see in what way (if correct,) it could add to the evidence of design afforded in such overwhelming abundance by the existing order of the system.

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* *Opticks*, Query 31, p. 378, 3d edit. † p. 344. ‡ p. 378.

Newton left all the irregularities, or perturbations (as they are called,) to be investigated by his successors. The most distinguished mathematicians since his time have been occupied in developing and simplifying these intricate but highly interesting questions. Lagrange and Laplace have been pre-eminently distinguished in this research; and to the profound analysis, especially, of the latter, we owe the establishment of the great principle, that all the variations which can arise from the mutual actions of the planets are limited by certain periods within which they must perpetually recur. This has been called "the stability of the planetary system."

"It is not, therefore," says Baron Fourier, in his *Eloge* of Laplace, "left, as Newton himself and Euler had conjectured, to an adventitious force to repair or prevent the disturbances which time may have caused. It is the law of gravitation itself which regulates all things, which is sufficient for all things, and which everywhere maintains variety and order. Having once emanated from Supreme Wisdom, it presides from the beginning of time, and renders impossible every kind of disorder. Newton and Euler were not acquainted with all the perfection of the universe."

Or, in the words of Laplace himself, "It seems that nature has ordered every thing in the heavens to ensure the duration of the planetary system by views similar to those which she appears to us so admirably to follow upon the earth for the preservation of animals and the perpetuity of species*."

This great discovery has become matter of unmeasured censure to those who were intent upon finding an immediate agency of the Deity in every event; and who were unable to see, that so far from detracting from the evidences of Supreme Intelligence, this recondite provision for the perpetual maintenance, of the order of the universe is, of all others, the most stupendous manifestation of eternal Providence.

Attaching importance, as we before observed, to the supposed necessity for Divine interference, to preserve the regularity of the system, they were of course proportionally offended at the announcement of the principle of physical stability. They were blind to the infinitely higher views thus disclosed.

They have applauded Newton for pointing to an ultimate cause "which is not mechanical," but they have been little able to perceive the nature or indications of such a cause. They have looked for the proofs of Omnipotence rather in great changes and sudden interpositions, but have not acknowledged infinite Intelligence in the continual invariable succession of ordinary laws, and the profound adjustment of all the varied trains of physical effects one to another, the preservation of uninterrupted and universal harmony among natural phenomena.

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* *Systême du Monde*, 442.

### *Resisting Medium.*

But though we find the principle of gravitation thus perfect within itself, and containing a perpetual source of reparation for all disturbances, yet here we must not restrict our speculations to the action of gravitation alone; no part of the universe, no physical principle must be contemplated in an isolated point of view. The consequences of gravitation must not be regarded alone without also considering other causes by which they may be modified; and the disclosure of the high probability that the planetary spaces are filled by a medium inconceivably rare, yet capable, in an immense lapse of time, of sensibly *resisting* the motions of the planets, opens to our view an extraneous cause which will modify the effects resulting from the action of gravitation alone. The perturbations may be perpetually compensated; but the orbits of all the bodies of the system will, by the resistance of the æthereal medium, take a gradually more and more compressed form, (as the range of a projectile is narrowed by the resistance of the air,) they will move with increased velocity, continually approach the sun in nearer gyrations, and at length fall into his mass.

The lapse of time which will be necessary to accomplish this is indeed so inconceivably immense, that we might well call the stability of the system perpetual. The probability of such resistance has only been evinced by certain extremely minute effects produced on the orbit of that singular and scarcely material substance, the periodical comet of Encké, a sort of unsubstantial thing, a mere wisp of vapour, which yet obeys the laws of impulse and gravity, and revolves about the sun. The æther then which offers a resistance barely observable to what is little more than an æthereal nebula, it may readily be imagined, has failed to produce any effect on the solid planets capable of being detected, in the entire period since the earliest astronomical observations.

It has, indeed, been contended by some able and philosophical writers, that there are few conclusions of science which so strongly force upon the mind the conviction of a Supreme power as those which refer to the finite nature of all created things; which make the period when the present order of nature did not exist, and predict the time when it shall cease; which point to a beginning and an end. However true and just these views may be with regard to the *origin* of the world, I must confess I fail to see their force with respect to the *termination*. The former unquestionably evinces the arranging and *designing* will of the Creator; but in the latter, it is difficult to see any such indications, unless, indeed, so far as we may venture upon the strength of the analogies of the past to look forward to a new order of things: to the substitution of a fresh series of recondite adjustments for those which may be destroyed; to the renovation of beauty and order out of decay and destruction; for the evolution of which that destruction *may* be necessary.

### *Proportions of Births.*

We may also here cite another example introduced by the illustrious writer last quoted, and in which he uses the term "final cause" in the same sense as before.

"La constance de la superiorité des naissances des garçons sur celles des filles à Paris et à Londres, depuis qu'on les observe, aparu à quelques savans, être une preuve *de la Providence* sans laquelle ils ont pensé que les causes irréguliers qui troublent sans cesse la marche des événements, aurait du plusieurs fois rendre les naissances annuelles des filles supérieuse a celles des garçons. Mais cette preuve est un nouvel exemple de l'abus que l'on a fait si souvent *des causes finales*, qui disparaissent toujours par un examen approfondi des questions lorsqu'on a les données necessaires pour les résondre. La constance dont il s'agit est un résultat *des causes régulières*[*].”

The slightest consideration will surely render it evident that the author here contrasts “final causes” or “Providence” with the idea of “regular causes” and fixed laws; manifestly using the former terms in the sense of “direct intervention.” When, however, we take those terms in the sense which we have before endeavoured to elucidate, the whole case is relieved of all difficulty and objection, and we find in those regular laws, and that constant maintenance of a particular proportion, the very proofs and essential notion of Providence and final causes.

### *Unexplained Phenomena: Tendency of Philosophical Conjectures.*

THE immense extent of our ignorance compared with that of our knowledge, is the reflection which has been only the more powerfully forced upon the minds of philosophers as discovery has advanced; and, in emphatic language, was the dying remark both of Newton and of Laplace. The bearing of this unavoidable confession upon the evidences of natural theology, deserves an attentive consideration.

It has been the favourite course with many inquirers to look anxiously to those parts of nature which are most hidden from our knowledge for the indications of the Divinity; to contend that when natural causes fail us, we are, in an especial manner, driven to admit direct Divine intervention; and that when mechanical laws apparently cease to apply, then we must more peculiarly recognize the dominion of the Deity. The view which I have been here endeavouring to illustrate is precisely the reverse. The evidences of the Divine operation seem to me manifested precisely in proportion as *we can* trace material laws and physical laws.

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[*] Laplace, *Essai Philosophique sur les Probabilités*, p. 103.

A world enveloped in entire obscurity as to physical causes, would, to my apprehension, be a world without the evidence of a Deity. An universe without appreciable laws would be a chaos, not a creation. And, by parity of reason, in those regions of nature, where we are most involved in ignorance, there, is the Deity most hidden from our perceptions. And instead of groping in the darker recesses where induction has not yet penetrated to find Him, we shall more rationally go forth to behold Him in those brighter regions which are illumined by discovered causes and demonstrated laws.

Yet so powerful has been the prejudice to the contrary, that not only have the unexplained obscurities of nature been religiously venerated as the penetralia of natural worship, but it has been held dangerous to indulge in the most philosophical *conjectures;* and impious to speculate on causes which may be most rationally *imagined* to prevail when we have no certain proofs to rely upon; as if, in so doing, we were profanely penetrating into precincts peculiarly consecrated to the Deity, and hallowed by his immediate presence.

### *Example: Nature of Gravitation.*

We may illustrate this remark by the instance of the essential principle of gravity which, in the present state of our knowledge, is wholly enveloped in mystery. But do we thence gain any thing in favour of final causes, or the belief in Divine agency? On the contrary, if future discoveries should disclose to us the nature of this universally mysterious agent, and bring it under the dominion of mechanical laws, we shall obtain so much the higher insight into the recondite mechanism of the world, and the more striking proofs of the skill of its Divine artificer.

Such were the sentiments of the most enlightened of Newton's followers even in his own times; and when, in the controversy to which his discoveries were at first exposed, the absurd accusation was urged by his continental opponents, that by pushing the physical explanations of phenomena beyond due bounds, the philosopher unwarrantably intruded into the region of primary causation, (according to the confused idea, so commonly prevalent, of their relative nature,) the reply of Dr. S. Clarke, (than whom no one was better able to see the theological bearing of the case,) was simply, " Si M. Leibnitz ou quelque autre philosophe peut expliquer ces phénomènes par les loix du mécanisme, bien loin d'etre contredit tous les savans l'en remercieront*."

### *Aggregation of Matter.*

To TAKE another example of those phenomena of the universe, which have not been reduced to mechanical causes, we may cite that which is dwelt upon by Newton in the following passage: "If *the matter* of the sun and planets was evenly disposed throughout an infinite space, it would never convene into one mass; but some of it would convene into one mass, and some into another, so as to make *an infinite number of masses,* scattered at great distances from one to another throughout all the infinite space. And thus might *the sun and the fixed stars be formed,* supposing the matter were of *a lucid nature.* But how the matter should divide itself into *two sorts;* and that part of it which is fit to compose a shining body should fall down into one mass and make *a sun;* and the rest, which is fit to compose an opaque body, should coalesce, not into one great body, like the shining matter, but into *many little ones;* or if the sun were at first an opaque body like the planets, or the planets lucid bodies like the sun, how he alone should be changed into a shining body, whilst all they continue opaque; or, all they be changed into opaque ones, whilst he remains unchanged; *I do not think explicable by mere natural causes,* but am *forced* to ascribe it to *the counsel and contrivance of a voluntary agent**."

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* *Replique de M. Clarke.* Leibnitz, Op. ii. 193.

Such was the *conjecture* of Newton in accordance with the existing state of philosophical views. He considered the phenomena " not explicable by mere natural causes," and therefore had recourse to a supernatural cause. But supposing the case allowed to be thus unexplained by any known natural causes, we have still to observe that it would afford no more *evidences* of supernatural agency than simply that which is furnished by the observed *facts* of the adaptation of the masses and respective physical conditions of the sun and of the planets to each other; and this evidence is unaltered whether the observed fact can be accounted for or not. And if it could be accounted for on any known physical principle, so far from detracting from the manifestation of design, this would only the more augment our impression of widely-pervading skill and recondite adjustment throughout the planetary world. But though we should admit that no cause *has* been assigned, it would be manifestly contrary to every principle of the inductive philosophy to affim that none can or will be.

When, therefore, we find Laplace suggesting what is, after all, professedly but a conjecture as to the probable course, merely, which inquiry might properly take on such a question, it ought neither to be regarded (as it has been,) as an unwarrantable extension of philosophical analogy, nor dreaded (as in some instances,) as in the least degree hostile to the argument for design; so far from this, if verified, it would but enhance the value of that argument. He, in fact, simply suggests, "amid these uncertainties the wisest course would be to devote ourselves to determining, by repeated experiments, the laws of affinity, in order to arrive at what would appear the simplest means of comparing these forces with that of gravitation."

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* *Letter I. to Bentley.* Works, vol. iv., p. 430.

If any law of affinity should ever be developed to such an extent as in any degree to meet the object here in view, (and we can never say that discovery may not be carried so far,) the only result surely would be the most overpowering conviction of the extension of the same vast unity of design throughout the mechanism of the material system.

## *The Nebular Hypothesis.*

Closely connected with this last case is the "nebular hypothesis," as it has been called, which has in a more peculiar degree, called forth the censures and obloquy of those who were intent on allowing no secondary means as the instruments or channels of the influence of creative power.

The luminous band called the "milky way," is resolved, by powerful telescopes, into a vast multitude of stars crowded together in infinitely lengthened perspective, and constituting an immense system of sidereal matter of an extended flat form, within which our planetary system is included, and of which our sun is merely one of the innumerable stars which make up the entire mass.

In various parts of the heavens the telescope discloses to us patches of diffused luminous matter called "nebulæ," bearing a general resemblance in appearance to the milky way as seen by the naked eye. Some of these are found by very powerful telescopes to consist of numerous stars, mostly appearing in the midst of a mass of diffused light. In some cases, the starry points are brilliant and defined; in others, more diffused, or merely points of greater luminous intensity than the surrounding region. Calculation assures us of the inconceivable distance from us beyond which they are situated, and measurement by consequence teaches us their enormous magnitude: so vast, that in many of them not only the solar system, but the whole mass of the milky way to which it belongs, would be lost. Thus we find, as far as observation can be carried into the vastness of the universe, besides distinct stars, an infinity of other systems of stellar matter, in the form of these "nebulæ," dispersed through space, and of which our entire system, included in the "nebula" to which it belongs, forms but one of the most insignificant.

We have also remarked the different states of diffusion in which these various nebulæ, with their stellar points, appear to exist.

So far exact observation has led us to the admission of facts which, however overwhelming to our conceptions, are nevertheless beyond question. Now *philosophical conjecture* has been applied to these *facts;* and, upon very reasonable analogy, astronomers have indulged in the contemplation of these different forms in which sidereal matter is presented to us, as exhibiting so many different *stages* in the progress of the formation of sidereal systems.

In the first instance, such matter seems to assume the form of a faint diffused nebulosity. In the next, some of these masses appear as if, in obedience to attractive forces, they had assumed a spherical figure; others, as if further advanced, have a denser central nucleus, surrounded by the more diffuse and yet uncondensed portion; others again, (to use the words of an eminent writer,) "in which the apparently unformed and irregular mass of nebulous light is just *curdling*, as it were, into separate systems." And further, there are some in a more complete condition, presenting a congeries of distinct points of light, each, perhaps, the sun of a system more vast and glorious than our own, but invisible to us; whilst in the case of the actual systems of double and triple stars, whose motions have been actually observed and calculated, we find the exact counterparts of our own planetary world, which have arrived at a corresponding point in the history of their constitution, as also probably is the case with the other fixed stars.

Analogical conjecture, then, has been broached (under the name of the nebular hypothesis,) to illustrate the process of the formation of our own system by what we behold in its different, and probably successive stages in other cases. It has been imagined that our system has been gradually evolved and condensed out of the nebula to which it belongs, and each of its planetary masses gradually consolidated from a previous state of expanded nebulosity. And this idea is further strengthed from the consideration of the probable high temperature from which our globe is believed to have cooled down to its present condition, and consequently to have undergone progressive condensation. While we have again the analogy of comets; nebulous masses of extremely attenuated matter, yet existing as parts of our system; and still further, what recent observation has rendered very probable, vast quantities of unconsolidated particles and small masses of matter traversing space, and occasioning the phenomena of aërolites and meteoric stones.

Such elevated ideas as these views are calculated to suggest, it might be supposed would be among those which, above all others, religious minds would be prone to cherish and delight in, more especially as carrying us a step towards a conception of the Creator's operations; yet, from some perversion which it is difficult to comprehend, no hypothesis has been more vehemently assailed and calumniated as at variance with all religious impressions.

## *Argument from Physical to Moral Causation.*

FROM what has been advanced, the proper course of our reasoning on these elevated subjects will be evident.

In physical science let us direct our inquiries to the contemplation of the order, arrangement, and adjustment among natural facts and laws, which we infer by legitimate induction. Let us keep the terms of our reasoning distinct and explicit, and conduct our sublimest speculations solely by an extended, but *wholly independent* collection of the universal manifestation of design and prospective arrangement, from the mere naked investigation of physical laws and causes. When such inferences have been carefully made,—when such indications have been dispassionately collected, then, in the order of just reasoning, we can advance to the sublime contemplations suggested by such evidences. This distinction, so often unheeded, is in fact the chief ground of Bacon's* reply to the censures cast on his system as neglecting the study of final causes, and which has been reiterated by some modern writers.

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* See *De Augm. Scient.*, lib. iii., cap. 4 and 5. For a full vindication of Bacon on other grounds as well as this, the reader will refer to Lord Brougham's *Discourse on Natural Theology*, part i., sect. vi. Also, Mr. Whewell's *Bridgewater Treatise*, chap. 7.

What he objects to is the violation of all correct order of reasoning by *assuming* the theological view of final causes in physical inquiries, where it should be the very thing to be *deduced and proved.*

The fault to be guarded against is that of taking any metaphysical notions of final *causes,* any reference to moral causation, as the basis and guide of physical theories. In proportion as we do this we vitiate the conclusions of natural theology by an argument in a circle. We assume the point to be proved. This was precisely the error of Descartes and his school. From assumed metaphysical ideas of the Deity and his attributes they affected to reason downwards to the deduction of the laws and phenomena of nature. "It is manifest," says Descartes, "that we shall follow the best way of philosophizing if, from the knowledge of God himself, we endeavour to deduce the knowledge of the things created by Him—that thus we may attain the most perfect kind of science, the knowledge of effects from their causes*." He was accused of neglecting "final causes." The fact was, in one sense, the consideration of them was in his system superfluous; in another, the whole theory consisted of nothing else.

This system was charged with having an atheistic tendency. In one sense, this was palpably untrue, as the whole of it was built on the supposition of the Divine attributes; in another, it might be open to the accusation if it be allowed that a system is injurious to the cause of religion which destroys and confounds all rational evidence of its truth. This remark may not be destitute of application even at the present day. The system of Descartes, as such, has now no adherents; but there are reasoners of several schools who fall into precisely the mistake here exposed*.

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* See his *Principia Philosophiæ,* &c. and for particular instances, *The Laws of Motion deduced from the Immutability of the Deity,* part ii., sect 37 and 42.

Thus then it is that the study of *physical causes* (understood in the simple meaning which we have before endeavoured to fix,) while it supplies the unassailable evidence of design and adjustment, as unavoidably carries us thence onward to the idea of an Intelligence from which that design emanated, and of an agency by which that adjustment was produced. It brings us, in a word, to recognise an influence of another kind, of an order *different from*, and far above that of *physical causes* or material action:—to acknowledge a sublime *moral cause*, the universally operating source of creative power and providential wisdom. But we grasp these truths only in their proofs and manifestations. Of the *mode* of influence or operation we are wholly and necessarily ignorant; even in ordinary cases of moral agents within the scope of our observation we fail entirely in conceiving the mode in which mind can influence matter; much more then must this be the case with regard to the unseen and infinite moral cause of the system of the universe.

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* See Note F.

### *Secondary Causes, and the First Cause.*

By such considerations as those above adduced on sound and unexceptionable grounds, we establish the momentous and elevated truth, of one great moral cause of all things; and in this sense, as referring to the idea of designing wisdom and infinite intelligence, we perceive the wide distinction between the use of the term "cause," and that adopted when we speak of secondary or physical "causes."

We have already noticed, in other cases, the ambiguities arising from the diversity of meaning attached to the same term "cause." Here, then, it becomes more peculiarly necessary if we adopt the popular expression, "the First Cause," to recur carefully to the distinction, if we would preserve any clearness of reasoning.

We refer to senses of the term absolutely distinct *in kind.* Nor is it a term of mere verbal difference. It is of importance, whether in guarding against fallacies in evidence or in answering the cavils of scepticism.

Now, the result of our inquiry into the nature of physical causes was such as to carry our ideas rather to the *extension* of order and uniformity than to the *suc-*

*cession* of efficient acts throughout the physical world; rather to simultaneous relation than to consecutive result. Expressions involving the idea of *priority in time* seem, then, calculated to convey erroneous impressions, at least in reference to the nature of physical laws or causes. And when we ascend to the contemplation of creative intelligence, the distinction is not between a prior and a subsequent train of material action, but between *physical order* and *moral volition.*

It will thus be apparent that the metaphor so often used of the *chain* of natural causes *whose last and highest link* is its immediate connexion with the Deity;—the very phrase of a succession of *secondary* causes traced up to a *first cause,*—and the like, (so commonly employed,) are founded on a totally mistaken analogy. They refer to a mere succession of mechanical impulses, traced up to a first mechanical power; to a series of physical changes, referred successively to some more and more general physical principle. The adoption of such a mode of representation when extended to the Deity would seem to make the first cause but one of a continued series of physical causes, and differing from them only in order of priority or generality. It would confound the efficient intelligence with the mere material manifestation of it,—the Creator with the creation.

If we retain such metaphorical language at all, it would be a more just mode of speaking to describe the Deity as the Divine artificer of the whole chain,

—not to connect him with its links;—to represent the secondary causes as combined into joint operation by his power and will,—but not to make Him one of them.

But the common figures, besides their manifest impropriety, are singularly ill adapted to place before our view the most important part of the truth, nay, are even calculated to hide and disguise it. For by the familiar use of these phrases the mind is habitually diverted from the consideration that this "chain," a portion of which we can handle and examine, is to be so examined to teach us the *skill* of the artificer; and instead of this we are led away to the irrelevant consideration of where the end of it may be fixed.

It then surely will be allowed of no small importance to preserve carefully the distinction between *moral* and *physical* causation. It is by this distinction that we advance from mere physical relations to any inference of a higher order of things. It is this which elevates our ideas from the mere material elements to the recondite intelligence which pervades the harmonious arrangement of them.

If we require the aid of metaphor in attempting to give utterance to those vast conceptions with which the mind is overpowered, instead of speaking of the first and secondary links in a chain of causation, and the like, let us rather recur to the analogy of the *arch* (before introduced,) and we shall be adopting at once a more just and expressive figure, and shall here run no risk of speaking as if we confounded the stones with the builder,—their mutually supporting force with the skill of the architect who adjusted them.

These considerations may enable us, then, to perceive the entire futility of those objections which are often urged against the study of secondary causes as being injurious to our due apprehension and acknowledgment of the first cause;—so far from it they, in fact, furnish the *sole* rational or natural means of leading us to that apprehension and acknowledgment; and, in the language of Newton, (understood agreeably to the distinctions before laid down,) "though every true step made in this philosophy brings us not *immediately* to the knowledge of the first cause, yet it brings us *nearer to it*, and on that account is to be highly valued*."

## *Argument from Design to Intelligence.*

We have thus far referred only, in a very general sense, to the notion we form of the great source of design and order in nature, or, in popular language, the First Cause, or Supreme Intelligence. In a more precise sense it may become a question, how far is this language and this inference borne out by any conclusions of our unaided reasoning powers?

From the regularity, permanence, and universality of *physical causation*, we conclude the existence of *a moral causation;* from the manifestations of order and purpose, we infer an ordaining and designing mind. That these are *natural* inferences and ideas almost unavoidably occurring to us, is perfectly true; but the very point of inquiry in natural theology is the *ground* of the inference and the analysis of the natural impression.

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* *Opticks*, Query 28, p. 345.

Now, it has been contended by some professed friends to religion, that beyond the bare fact of order and fitness we can really infer nothing by the mere powers of reason; and that the conclusion of an independent intelligent supreme existence, if it be anything more than a mere truism, is a vain presumption; that in one sense, it is mere tautology to say, that design implies a designer; or else, in another sense, idle to suppose that our finite reason can teach us anything of the purposes or nature of an Infinite Being*.

Now, the bare fact of order and arrangement is on all hands undisputed, though commonly most inadequately understood and appreciated.

The inference of design, intention, forethought, is something *beyond* the last mentioned truth, and not to be *confounded with it.* This implies intelligent agency, or moral causation. Hence again, we advance to the notion of distinct existence, or what is sometimes called personality; and thence proceed to ascribe the other Divine attributes and perfections as centering in that independent Being.

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* See Irons *On Final Causes*, p. 116, &c.

Such probably would be the distribution of our thoughts as successively pursued, if we proceeded to any systematic analysis of our reasonings on the subject. It is not, perhaps, a species of examination to which many are inclined, even of those who take delight in the general contemplation of the truths with which they are impressed by the examination of the natural world.

Yet a careful consideration of the orderly series of simple elements into which we can analyze our conceptions, is of eminent use (even though we do not practically and habitually go through such a process every time we think on the subject). It enables us as well to assure ourselves of the validity of our own conceptions, as to detect the fallacies of sceptical objections.

Now here I conceive we shall have no need to enter upon any abstruse or difficult discussion. I believe it will suffice to elucidate the subject, if we simply look to the *use of language*. In analyzing the train of inferences or ideas referred to, the consideration of the origin and precise meaning of the *terms* we employ appears to me most vitally essential, and yet most commonly overlooked; while, from the neglect of it, most of the misapprehensions which prevail on the subject take their rise.

We observe the indications of mind displayed in the works produced by the moral causation of voluntary agents and intelligent beings within the scope of our observation. We follow up an *analogy* between these and the vast manifestations exhibited in the order of nature; and from this *analogy* we attempt, however inadequately, to express our limited and imperfect conceptions of the infinite and incomprehensible moral cause of the universal order and system of natural causes.

The same remark applies to the further inference of the *distinct existence* of the source of moral causation, our whole notion of which seems to depend on our idea of the relation of moral causation to mind, in the cases within our experience. The metaphysical notions which seem to be involved will, I believe, be found to resolve themselves into the same simple consideration of the use of terms applied *by analogy* from what we experience in ourselves and in beings about us. This I conceive will, on reflection, be found the clue which will safely guide us through at least a large portion of the intricacies of the subject. Considerations of this kind, however, are vitally necessary to the argument of natural theology; and this portion of the subject, involving what has been termed "the psychological argument," is beyond question most essential to an exact and philosophical discussion, though certainly not placed in a sufficiently prominent light, if regarded at all, by some of the most excellent and popular writers*.

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* See Note G.

### *The Divine Supremacy.*

We may here observe further, that if we retain the popular language, and speak of the *first cause* and *secondary* causes, we must, at all events, bear in mind that the term "first," is *relative.* We cannot extend our conclusions beyond our evidence. It is entirely from our investigation of "secondary," or physical causes, that we can recognise the sublime moral cause which ordered them all. It is thus manifest that we can properly attach no other idea to the term "first cause," than one which is simply *relative* to these "secondary causes." Natural theology cannot lead us to any higher inference. Nor is it any reproach to this science that it does not enable us to proceed beyond the limits of its own province; nor to answer the question sometimes propounded in this form of illustration: "The examination of a watch leads us to infer a watchmaker, but it cannot answer the further question, who made the watchmaker*?" Yet this question has been made the subject of much misapprehension and objection, mainly, as appears to me, from want of reflection and caution in the use of words; or, perhaps after all, rather from some feeling of offence taken at the mere form and terms in which the illustration has been propounded.

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* For an acute and original statement of this point (which has called forth much animadversion,) the reader is referred to Mr. Combe's *System of Phrenology*, vol. ii., p. 592.

Throughout the utmost extent of our investigation of physical causes, we trace the proofs of that moral volition which is *prior* and *superior* to them all; proofs exhibited alike throughout all the vastness and all the minuteness of the universe; increasing and augmenting in overwhelming multiplicity, with no other limit than that imposed on the extent of our observations and inductions. As far as science has reached, and in whatever direction, we still discover this same moral cause; transcendant in a supremacy co-extensive with the creation; sole in dominion to all the extent of known worlds; and continually exhibited to us one and the same, by every new extension of knowledge, every fresh incursion of science into hitherto unknown regions. And this constitutes our inductive ground of belief in what we term the *supremacy* of the same one moral cause and source of the entire order of physical causes; the first relatively to them; a Divine power supreme *to us* and to all created beings.

## *The Divine Unity.*

THE unity of the great designing Intelligence has been commonly inferred from the observed unity of the design. But objections, as to the insufficiency of the proof, have been adduced. Such objections, however, it appears to me, can only be entertained from a want of that comprehensive study of physical philosophy which alone can convey any adequate conception of the vast and overwhelming evidences of that unity of plan and harmony of purpose which pervades the utmost limits of the known creation.

Let it be observed that the belief in the Divine unity has advanced with the advance of sound inductive science. The ancient philosophers, though they collected *facts*, were wanting in comprehensive *induction*. They reached to just conclusions within the narrow limits of certain isolated classes of facts. But they had no principles of analogy to connect one class of facts with another. They imagined nature in general to be given up to almost total anarchy; and the universe, an arena for the perpetual combat of conflicting elements. With this deficiency in their apprehension of the relations of physical causes, it is hardly matter of surprise that they admitted a plurality of gods, or an unlimited number of powers and agencies, whether subordinate or independent.

But the introduction of a more just philosophy has entirely exploded all such vain imaginations. The inductive method has applied the key to open to us a view of the sublime but simple order of natural causes. And from that universal and unceasing unity of plan in the laws of physical action has been derived our rational proof of the unity of the Deity.

Nevertheless it has been urged that unity of plan *might* result from the co-operation of several minds, powers, or agencies*. But to suppose many causes, when one will suffice, is clearly unphilosophical; and besides this, the objection, however plausible, when stated merely in an abstract form, will vanish the moment we reflect on the actual case of the material creation. When we consider, especially on the grounds adduced in the previous portion of these remarks, the immense multiplicity of physical arrangements, all so admirably harmonizing together; the *infinite combination* of adjustments, each arranged in exact relation to the other, as well as complete within itself; we cannot but feel overwhelmed with the conviction that to one Omniscient mind alone can be correctly attributed such infinite forethought, and such boundless comprehensiveness of arrangement.

### *Objections to the Study of Secondary Causes.*

To the neglect of such simple distinctions as those we have been engaged in illustrating, and from misconception (mainly caused by ambiguity of terms,) as to the nature of physical causes, and the relation in which they stand to the Divine Intelligence which has constituted them, may be traced most of those objections and prejudices which prevail with regard to the tendency of physical studies and the inquiry into secondary causes.

* See Irons *On Final Causes*, p. 134.

We hear much alledged against the study of physical causes, as having, at best, a tendency little congenial to religious reflections, and even hostile and injurious to its spirit. By confining the attention (it is commonly said,) to the investigation of secondary causes, the thoughts are habitually withdrawn from the first cause.

But such objections only furnish, in fact, instances of the confusion of ideas from the ambiguous use of the term " cause." And they immediately disappear when we come to distinguish the meaning correctly.

Even if the allegation were true that this dissociation of ideas is encouraged, what does it amount to but an accusation that we withdraw our thoughts from the *conclusion* in order to pursue the *proof?* What is it but the absurd charge that by giving our attention solely to the *evidence,* we indispose our minds for the *inference?*

### *Scientific Details.*

Prejudices against the minute investigation of nature as an unworthy and trifling pursuit, have not unfrequently been entertained by those who were profoundly ignorant of the object and tendency of such pursuits, and of the necessity of such precise inquiry for establishing the conclusions of all sound philosophy. The cultivators of science have often been condemned to hear such aspersions cast upon their labours. And to see the genuine spirit in which they were answered, we may cite the testimony of the illustrious father of British astronomy, who, upon a suspicion that his sublime pursuits were treated with ridicule, (in a letter to Newton,) expresses his wonder that these occupations should be "looked on as trifling. . . Other persons (he says,) that come after me will think their time as little mispent in these studies as those did who have gone before me. The works of the Eternal Providence, I hope, will be a little better understood through your labours and mine, than they were formerly; think me not proud for this expression; I look on pride as the worst of sins, humility as the greatest virtue*."

And the sentiment so nobly avowed by Boyle, when taxed with the childishness of his occupation in watching the colours of soap-bubbles, deserves to be ever borne in mind as well by those who cultivate, as those who cavil at physical inquiry; "nothing can be unworthy of being investigated by man which was thought worthy of being created by God†."

But science is often assailed with the charge of being wholly conversant with objects of sense, and that, confining us to the world of matter, it restrains and disables the mind from the more worthy and elevating pursuit of moral and spiritual truth.

If, however, physical science be restricted to objects of sense, those very objects form the steps by which we ascend to the evidence of mind; if natural philosophy be conversant solely with the visible creation, it is by the light of that which is visible that its true disciple penetrates beyond those limits into the presence of Him who is invisible.

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* Baily's *Account of Flamsteed*, p. 169.

† See Note H.

When, therefore, we hear the assertion (so sacred in the eyes of many,) that experiment can never carry us beyond the region of matter; that by physical induction we can never attain to truth in its legitimate and only valuable sense; and that "all real philosophy radiates from the knowledge of God;" in such declamation it is difficult to discover any thing but a hopeless confusion of thought, most commonly assisted by a thorough ignorance of the nature of inductive science, and a total misconception of the very aim and character of philosophical inquiry.

Or again, they contend that "natural theology is entirely founded upon vain curiosity and profitless speculations concerning the intentions of God;" and are loud in their condemnation of the arrogance which would lead a finite mind to attempt to comprehend the counsels of the Infinite; blind entirely to the fact that no such attempt is ever made, no such object aimed at; since, in inferring *design*, the inquirer is always foremost to confess his inability to trace its indications to the smallest extent beyond the limits which actual inductive evidence warrants.

### *The Pride of Science.*

NOTHING is more common than to hear persons ignorant of physical science enlarging upon what they term the arrogance of the philosopher in drawing his conclusions, and pretending to determine what is, and what must be, in regions utterly beyond the limits of sensible experience; nothing more usual than to meet with those who talk not only with disbelief, but with ridicule, of the theories of the scientific pedant; and in the most solemn tone, declaim against the pride of reason and philosophy as essentially hostile to the humility of faith. They seem to regard the speculations of physical science as mere fancies, in which the philosopher indulges for the sole gratification of his own wayward presumption, and in virtue of which he may assume a claim to the admiration of the vulgar. Little considering that these very speculations afford the only legitimate and substantial ground on which a reasoning inquirer can build his most sublime proofs of the existence and attributes of the Divine Being,—that those very theories are nothing else than the expression and the embodying of that all-pervading analogy and order in which the universal manifestations of the Divine mind are disclosed to us.

So long as correct induction is our guide, we may with safety pursue physical speculation to any extent. The only real presumption is in the departure from sound inductive principles, and the attempt to interpret nature without their aid. Inductive research undoubtedly claims the right of an absolutely unlimited extent of inference, even when it points to objects too vast or too minute, too remote in space, or too deep in the abyss of time, to come at all within the grasp of our faculties. The sole consideration it regards is the accuracy and truth of its evidence; if this be in the first instance firmly established, the true philosopher will never shrink from admitting all its necessary consequences, however inconceivable may be their nature, and incalculable their extent.

If there were any reasonableness in prescribing such limits, if there were any real ground of doubt as to the universal preservation of the analogies of nature, it must be carefully observed that any such limitation would amount, in its direct consequences, to a limitation in those inferences on which we frame all our notions of the Deity; any such ground of doubt would (as far as it went,) tend to discredit our proofs of the Divine perfections.

If the deductions of science are unwarrantable intrusions of the vain imagination of the self-sufficient philosopher into those vast regions of creation which are purposely veiled from us, the objectors seem to forget that, by necessary consequence, they make the sublime conclusions of natural theology also an unwarrantable stretch of inference. If they attach the charge of presumption to the speculations of natural science, it must be remembered they thereby attach the same accusation to the deductions of natural theology. If they condemn the conclusions of physical reasoning as arrogant and impious intrusions of human self-conceit into mysteries beyond the reach of the human faculties, so, by necessary consequence, they involve in the same condemnation the inferences which are dependent upon those researches, the belief in the infinite perfection, the unlimited immensity, power, and eternity of the Deity.

To some it is a peculiarly favourite topic, that the powers of the human mind are but limited; that there are mysteries in nature which must for ever baffle the most acute research; and, not content with the assertion that there are such boundaries imposed on all human speculation, are prone to affirm that the boundary has been reached whenever they meet with an unexplained phenomenon. They seem to dwell with special satisfaction on the circumstance that here is an instance of some natural wonder, in the comprehension of which the greatest philosopher is as much at a loss as the ignorant peasant. Such instances they often hold out as instructive and salutary checks to the pride of science, and humiliating to the pretensions of intellectual superiority. In reality, however, instead of the lofty moral tone which they affect, these reflections but too clearly betray the mere invidious workings of narrow prejudice, in which self-satisfied ignorance consoles itself*.

But to those who rightly estimate at once the real powers of the human mind and the true character of the inductive method, it will be manifest how irrational such sentiments must be. So long as we follow diligently, and with becoming caution, the humble, but sure path of induction, we can never arrive at any bar to our inquiries except those which are imposed by the deficiency of facts; and we know by the testimony of all past experience, that the disclosure of new facts is daily advancing, and must perpetually accumulate. It is by the continual accession of fresh phenomena that new paths will be perpetually opening to judicious induction; and, by consequence, we may unhesitatingly anticipate perpetually new and extended manifestations of order and arrangement in nature, of Divine power, wisdom, and beneficence.

To indulge, then, in the low and absurd reflections just adverted to, is nothing else than to rejoice in the deficiency of proofs of the Divine perfections. It is to delight in blindness to the manifestations of Divine power and goodness; to prefer darkness to light, and to evince a disposition of congenial character. It is to refuse to recognise the proper and highest use for which our intellectual faculties are conferred upon us.

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* See Note K.

### *Interposition:—Permanent Laws.*

The notion of physical cause and effect being reduced to a bare "sequence," has been strongly objected to as injurious to the belief in the Divine agency in nature; and the supposition of an acting efficient cause in every natural phenomenon, has been emphatically insisted on as necessary for the support of that doctrine. But from the view we have here taken of the nature of physical causes, and their relation to moral, we see that, so far from supporting, the supposition of such direct perpetual intervention would, in fact, invalidate the evidence of a First Cause.

According to the view here supported of the nature of physical causes, it has sufficiently appeared that, in including in our idea the relation of the more particular to the more general fact, we have assigned the origin of our ideas of the closest and most inseparable union of cause and effect; and this relation is obviously dependent upon the degree in which we can generalize among the phenomena of nature; that is, upon the degree in which we can trace order and arrangement. Thus, the greater the extent to which we can trace physical causes, in this sense, the more surely founded is the inference of moral volition and all-powerful intelligence, derived from the contemplation of this order of causes.

And when we reflect upon the unbounded vastness of nature, which expands under our examination, and which receives enlargement continually from every additional advance which the practical application of science confers on the perfection of our senses,—when we find the same beauty and uniformity preserved throughout the utmost range of our observations,—and when we add, that all this is but a small speck in the actual immensity of the universe—we surely derive the highest possible proofs and indications of recondite and perfect adjustment through the extent of the visible world: so that we can but by feeble and dim analogies, most imperfectly express our partial apprehension of a presiding and all-pervading Divine Intelligence. Again, if we turn from the consideration of space to that of time, it is only by deciphering the monuments of the immense periods of successive organization, up to the epoch of the first existence of animal life, that we learn the testimony of nature to the fact of creation, or rather succession of creations; and, in conformity with our limited conceptions, speak of the infinite wisdom and skill of the Divine Intelligence, the infinite power of the creating Deity.

Unless we consent to reason from the analogy of known causes to those which are unknown,—from the present to the remotest epochs of the past, we must lose the whole argument from the continuance of order and arrangement; we must be deprived of our sublimest conclusions which result from the permanence of the indications of design and harmonious adaptation. If we could trace material action no further than to resolve every effect into the result of an immediate arbitrary intervention, the real evidences of Divine intelligence would be wanting.

We thus perceive the futility of such charges, as that by establishing the uniformity of second causes we impair the evidence of the Divine interposition; that by extending our researches into nature we encroach on the dominion of the Sovereign of nature; and that by enlarging the range of physical agency we detract from the majesty of the Divine power; whereas it is by these very researches that we establish and acknowledge His sovereignty, and find in that very agency nothing else than His delegated authority.

As reasonably should we construe the tranquillity of a well-ordered community into a proof of the defective energy of the sovereign power, because the daily immediate manifestation and interposition of that power was not necessary to carry on the government. As well might we consider it to detract from the perfection of a piece of machinery, that it did not require the perpetual interposition of the artificer to keep it in action*.

## *Conclusion.*

In what has preceded, it is to be hoped we have sufficiently shown how harmoniously and universally the results of physical inquiry, with one consent, all point to the existence of recondite principles of arrangement throughout nature, of vast and universal design. Every separate instance of adjustment does this by the evidences it contains within itself. But the wonderful combination and multiplication of such evidence can only be appreciated from the extended comparison of general laws, and the analogies by which those laws are related. This supplies the most powerfully accumulating proof of ordaining Intelligence and Almighty Mind.

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* See Note L.

The inconceivable minuteness on the one hand, and the immense extent on the other, to which we find these analogies still accurately preserved, are, perhaps, of all other considerations, the most efficacious in impressing us with the notion of the Divine perfections. The unbroken continuation of the same order and analogy, whether throughout time or space, joined with the consideration that all this is but finite, is the reflection which, above every other, must inspire us with the most truly exalted notions of the Divine immensity and eternity.

From such considerations we may, perhaps, better appreciate the real office of inductive philosophy, and the nature of the service it discharges as ministering to the sublime truths of natural theology. The existence of some universal principles of analogy and uniformity is the ground of all inductive science. The tracing out of such analogies through all their actual physical indications, is that which furnishes the great argument of natural theology. And we acknowledge that this preservation of uniformity and analogy, (which we have seen supplies the natural preliminary conjecture in all induction,) is, in fact, the very indication of the universal presence and all-pervading energy of the one Divine mind. Thus, then, these momentous and sublime conclusions rest upon a common basis with those of inductive science, and thus invest science with the high sanction of their own sacred character. Established by physical research, they react upon it; they supply the most elevated motive for the prosecution of the study of nature; and the glorious truths which manifest themselves as we proceed, cast back a lustre on the path by which we have advanced, and encourage the endeavour to approach their Eternal source.

So far from any advantage arising to the stability of natural religion, or any augmentation of force to the impressions of natural piety, when nature remains veiled in mystery, and we are compelled to own our ignorance of the modes and laws of her operations, it is, in fact, the very unveiling of those mysteries, the dispersion of that mist of ignorance, the disclosure of the secrets of physical causation, which supply the very proof and defence of the truths of natural theology. The acknowledgment of Supreme power and wisdom, instead of being banished from that portion of nature which we can subject to inductive investigation, is there pre-eminently established as in its more peculiar sovereignty.

And it is in the very advance from what has been termed "the region of facts, to that of laws*," or in other words, from the region of unconnected observation and mystified speculation, into that of clear arrangement and luminous generalization, that we, in proportion, approach towards the worthy conception of the great Source of order, the eternal Cause of all the beauty and harmony of the earth and the heavens.

And the greater the advance made by scientific research in the reduction of the phenomena of the world under definite laws, so much the more firmly will the foundations of real religion be consolidated; or (to adopt the forcible words of a writer† of the present day,) "Though the atoms of the universe may be weighed and measured, and every seeming accident shall be reduced to order and to rule, the reasons for adoring the Creator, and trusting in him, and obeying him, and for loving our neighbour as ourselves, will only be proportionally multiplied."

The combined powers of physical science, so far from being leagued in the vain attempt to expel the Sovereign of nature from his rightful dominion, on the contrary, are, in truth, firmly allied in the glorious purpose of upholding the acknowledgment of his supremacy, and surrounding the throne of Omnipotence with the unceasing homage of the trophies they have achieved.

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* Whewell's *Bridgewater Treatise*, p. 349.

† *Remarks on Demonstrative Reasoning*, &c., by the Rev. E. Tagart, p. 127.

Natural science may be disparaged by some as the proud creation of human intellect, as beginning in presumption, and ending in irreligion, or at best, withdrawing us from what is spiritual to what is material. If, however, physical philosophy be human reason employed in investigating the material world, though the process may be of human origin, the subject-matter is not. Reason is but the instrument, and induction the art; but the materials are the universal creation. And if science be human, yet nature is divine; and the science of nature is but the rational evidence of God. But even intellect and science are his gifts, and the human mind his workmanship; when, therefore, we are able, by the exercise of these powers, to investigate his works, we are, ourselves, furnishing most recondite proofs of the fitness of his works one to another, and of the adaptation of the intellectual to the material order of things; and are but filling up an essential part in the universal harmony of his creation. When we devote our minds to the study of his works, we are but employing what He has bestowed, in his own service; we are but rendering back his own, it may be hoped " with increase."

If there be those who feel a disposition to undervalue inductive inquiry, (in the sense which we have shown it essentially to bear,) who are inclined to disparage physical investigation, and declaim against the inferences of experience and analogy, and the presumption of reasonings grounded on the uniformity of natural causes; let such persons be persuaded to pause for a moment, and learn caution, by the consideration that in any censure cast upon such trains of inquiry, and such principles of rational speculation, they are, in fact, casting censure on the very elements of the great argument of natural theology. Let them recollect how intimately the one is wound up in the very texture of the other, and avoid the reproach not less of inconsistency than of ignorance, not less of irreligion than of folly, which must attach to those who, under the plea of defending religion, would thus sap the very foundation of its evidences.

# SECTION IV.

## THE RELATION OF NATURAL THEOLOGY, AND OF PHYSICAL SCIENCE, TO REVELATION.

"Philosophia naturalis post verbum Dei, certissima superstitionis medicina est; eademque probatissimum fidei alimentum. Itaque, merito religioni donatur tanquam fidissima ancilla, cum altera voluntatem Dei, altera potestatem manifestat." Bacon.

"Cœlum enim materiatum et terram, qui in Verbo Dei quæsiverit, (de quo dictum est 'cœlum et terra pertransibunt, verbum autem meum non pertransibit,') is sanè transitoria inter æterna temerè persequitur. Quemadmodùm enim theologiam in philosophiâ quærere perinde est, ac si vivos quæras inter mortuos; ita contrà philosophiam in theologiâ quærere non aliud est, quam mortuos quærere inter vivos."
Bacon, (*De Augm.*, ix.)

"He that takes away reason to make way for revelation, puts out the light of both; and does much the same as if we should persuade a man to put out his eyes the better to receive the light of an invisible star by a telescope." Locke, (*Essay*, iv. 19, 4.)

### *Introduction.*

We have thus far been examining the principles by which our study of external nature can alone be safely and conclusively carried on, so as to lead us, by sure stages of reasoning, to the sublime inferences of all-pervading design, of infinite wisdom and power; to the elevated and elevating apprehension of the

Divinity, in whom all those perfections centre, and from whom the entire order of nature emanates. We have seen that a primary persuasion of uniformity in nature is the guide to all our inductive investigations, and is universally confirmed by the appeal to experimental evidence, from which we ascend to laws and principles of successively higher generality and comprehensiveness. From such successive generalizations we arrive at the idea of secondary (or properly) physical causes; and from the contemplation of their uninterrupted order arises our conviction of universal design and intelligence in the adjustment of the natural creation: whence again our belief in the existence and perfections of the Creator or First Cause: the great source of that moral causation in which all physical causation originates. We have noticed the importance of keeping the order of this train of reasoning steadily in view; that is, if we would have our belief regulated by any rational principles. We have seen that it is absolutely essential to commence with purely physical investigation by the sole method of induction; and that any departure from this method, any reference to other grounds of belief, any attachment to preconceived notions, any appeal to the dictation of authority, are totally inadmissible, if we would preserve unbroken the course of rational evidence and deduction in this most important argument.

I have said "rational" proof, because (as has been already remarked,) there are many who disparage physical science, not only on general grounds, but particularly under the extraordinary miconception of thereby advancing the cause of religion,—while, in truth, they are thus vitiating all rational evidence of religion.

Those who decry reason are not likely to be very logical in their own arguments. They do not perceive that, in discarding the proofs of reason, they are cutting away the pillars of the temple of faith. In censuring physical philosophy, they are vainly assaulting the bulwarks of natural religion, and are attacking their own allies in the dark. When on religious grounds they disparage and condemn the study of physical truth, they do not see that, in proportion as their arguments might be valid, would the proofs of their own religious principles be assailed. In rejecting the evidence of inductive science they are rejecting that of natural theology. And while they so vehemently declaim on the weakness and insufficiency of the powers of the human mind for investigating religious truth, they do not consider, that it is precisely on this ground that we would restrain its speculations to the plain and humble method of inductive research into the facts and laws of the natural world, and the sublime but insufficient deductions from them which lie properly within its province; thence to be prepared to advance towards those higher attainments of religious illumination which supply all the deficiencies of mere natural reason.

In pursuing the subject of the connexion between the truths of natural theology and those of revelation, and of the independence, on the one hand, of physical science as the basis of the evidence, and on the other, the mutual relations of these several great branches of the inquiry, I will commence with a few remarks on those primary doctrines which exercise so important an influence on the views taken of the authority and tenour of revelation, and on the extent to which natural reason alone can guide us in those inquiries; on the limit at which its own light fails us; yet the degree of illumination which we must possess, in order to find our way even to the point where we are to gain access to fuller disclosures.

### *Our Ideas of the Divine Attributes.*

Some difference of opinion has prevailed as to the mode by which we arrive at our conclusions respecting the Divine Attributes. It has been maintained, on one side, that those conclusions are of the most limited nature. It has been contended (and with much appearance of reason,) that our inferences can only go to the extent of our evidence; that the ideas of the Divine Attributes which we acquire in natural theology can only be legitimately framed and recognised in the degree and character in which the facts of nature present the manifestations of them; that we can infer the Divine eternity and immensity only from those ideas of duration and extension which the conclusions of geology and astronomy suggest; that we obtain our notion of the Divine Omnipotence only from those uniform laws and unchanging processes in which it is developed; that we arrive at our conception of the Divine beneficence only from the contemplation of good, mixed with evil; that, as far as natural theology is concerned, no adequate ideas of those attributes can be acquired, or are even adapted to our apprehensions, but those which the contemplation of physical analogies suggests. In all these particulars the conclusions of natural theology simply are extremely imperfect and insufficient. But we have no other ground on which to frame our apprehension of a Deity in the first instance. The deficiency can be supplied only by the subsequent reception of the doctrines of revelation.

To this reasoning it has been objected, that it would leave us with inferences of such attributes as not only fall short of any worthy notion of the Deity, but are even at variance with all idea of moral perfection; as, for instance, in the case of *beneficence.* Mere reasoning on natural phenomena would only give us an idea of the production of good, mixed with a considerable share of evil. It has, therefore, been contended, that we do not, in fact, form our conclusions without assuming the perfect and universal beneficence of the Deity as antecedently probable; and thus, guided by this idea, conclude from the manifestations of nature, which *partially* confirm it, the universality and infinity of the Divine benevolence; regarding the partial instances of evil as, in fact, only apparent and not real exceptions,—as merely seeming to be such from the imperfection of our apprehensions. And this assumption has been traced to the inherent moral sense of human nature, which naturally perceives the perfection of moral good, and thus cannot but suppose it in an infinite degree in the Deity*.

I will merely remark,—1st. When we *abstract* from this moral sense, it seems on all hands admitted, that *bare reasoning* on the facts of the natural world can conduct us no further than to the inference of good mixed with evil, or to the idea of a mixed attribute of beneficence not absolutely infinite.

2dly. Bare reasoning (without the moral consideration,) might nevertheless lead us to allow that the evil was only apparent in consequence of our limited apprehensions. Thus, without referring to the moral sense, mere natural theology might leave us with an idea, *extremely defective*, no doubt, but still *not contradictory* to any more worthy views of the Divine nature afterwards to be inculcated; but, on the contrary, from the manifest deficiency, we should be rather anxiously predisposed to receive such better intimation.

3dly. The question as to the operation and origin of this moral sense, is one which is itself properly open to investigation as a branch of metaphysics of great importance to natural theology and moral philosophy:—the question whether such a sense is really *inherent* in human nature or *acquired?* Or, if universal and natural, whether it may not be analyzed into *simpler elements?* Or, again, admitting that man *is prone* to entertain such ideas, whether this be grounded in reason?—are all points claiming most serious examination.

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* On this subject see Archbishop King's *Discourse on Predestination*, with notes by Archbishop Whately, Appendix, p. 119.

My object in these remarks is merely to direct attention to such important topics of inquiry, without pretending to enter into the full discussion of them, much less to propose a solution of the difficulties. The preceding observation refers particularly to the single instance of the attribute of beneficence; but similar remarks must apply to the natural evidence of the other Divine perfections.

The attribute of omnipotence, for example, is evinced by our reasoning upon the inconceivably vast indications of power displayed in the visible creation. We discover everywhere the marks of such power exerted to a degree beyond all possibility of conception in its intensity and magnitude. Yet we observe it only exercised *in particular ways.* We infer directly its infinity *in degree,* but we cannot strictly conclude its extension to all *kinds* of operation. We recognise its effects in constituting and originating, in adjusting and upholding, the order of physical causes; we perceive its operation in regulating the existing state of the universe, and in the gradual evolution of the existing frame of the world out of previous orders of existence; we trace its mighty manifestations, stamped with the same unchanging attributes of immensity, through countless ages of duration, and through the boundless expanse of space; but it cannot be said that mere reason can therefore infer any other *kind* of exercise of this power.

Let it be distinctly borne in mind that the object of these remarks is solely that of caution as to the proper limits of the mere reasoning upon physical order, which is the strict province of the *science* of natural theology.

There is, however, another point of view in which this subject is often regarded, to which I must allude, though, as not strictly belonging to our present subject, it can be but cursorily noticed, however important in itself. The Deity is proposed as the object not merely of our belief, but of our practical adoration and love, in the imitation, limited and imperfect as it must be, of His moral perfections. Hence the vital practical importance of the most unimpeachable conception of those attributes, and of removing every thing like a limitation on their infinite moral excellence. With the object of maintaining this practical view, many excellent writers have gone into a variety of speculations, directly imposing limits on our ideas of some of the Divine perfections, lest they should be at variance with the infinite excellence of others. Thus it has been distinctly argued, in order to vindicate the Divine benevolence, that we must suppose the Deity *unable* to prevent evil; or, in other words, deny his omnipotence*.

Of such reasonings I will here say no more than this: they are maintained and highly approved as propounded by the very able writer just referred to, by parties of the most unquestionable piety and religious zeal. Those, therefore, who allow and admire these views, can have no right to object to other speculations, which, in like manner, tend to limit our conclusions as to the same attributes. "The truth is, the only rational conclusion which we can arrive at in the matter, is, that in the nature of things, no such attribute" (*i. e.* as omnipotence) "can exist†." These are the words of Mr. Woodward. I very much question whether expressions infinitely less bold from other quarters, would not be set down as absolute atheism, by the same religious party who admire Mr. Woodward. Such, however, is too often the inconsistency with which cavils are urged against the freedom of inquiry, which we must of necessity claim, in any profitable discussion of the truths of natural theology.

In like manner, writers of the Calvinistic school have anxiously insisted on the want of any proofs of the infinite benevolence of the Deity; thus fortifying their system against the most obvious and forcible objection drawn from the inconsistency with that attribute, in supposing a condemnation to eternal misery without moral criminality in the irresponsible victim of reprobation, or the possibility of effecting any ulterior good, when the punishment is endless. Yet such persons would be the first to exclaim against putting any limitation on our notions of the Divine power or wisdom, as impious and atheistical.

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* See *Essays and Sermons*, &c., by the Rev. H. Woodward. London, 1836; especially Essay XV.

† *Essays*, &c., p. 177.

## *Limits of Natural Theology.*

The general question as to the extent to which the conclusions of natural theology strictly and legitimately reach, has been the subject of much difference of opinion. One class of reasoners have been prone to invest their inferences with a systematic completeness, which is but illusory: while the perception of this has afforded some colour to the opinion of others, who have as strenuously denied that mere reasoning on these subjects can teach any substantial or satisfactory truths.

And those who do not go these lengths have contended, that what we certainly learn from the admitted facts of order and adjustment in the material world, is in truth very little. That we can advance only to the inference of the mere existence of some powerful intelligent cause; that we can rise only to a vague apprehension of some superior power displayed in the adaptation of created things: but that we can ascend no further as to any practical results: that we learn nothing more than (as they term it) a "quiescent intelligence:" that we can deduce nothing as to active superintendence of the world and the affairs of men: that (in a word) natural theology teaches us nothing of a *moral governor* of accountable moral agents: nothing of our own nature or destinies: nothing of incorporeal existence, or a future state. For all information on these subjects, they contend we must refer exclusively to revelation.

These are undoubtedly questions not only most fairly and legitimately open to discussion, but of great moment and importance in a satisfactory analysis of the grounds of religious belief. Certainly great diversity of opinion has prevailed with respect to them: and, it must be allowed, may very reasonably prevail.

I will merely offer one remark as to the entire spirit and character of such inquiry. I conceive it is an equally mistaken view, to prosecute it as supposing it to involve *the credit* either of natural theology on the one hand, or revelation on the other. It neither at all affects the truth or value of natural theology, to admit that it may be deficient in some points, or that they may not properly belong to its province: nor is it any disparagement to the just estimate of our reasoning powers, to confess that they may find their limit when we arrive at certain parts of this vast subject.

On the other side, it does not appear to me at all essential to support the credit, or enhance the perfections of Divine revelation, to make out that it is the *only* source of information on topics of this nature: or to allow that reason may supply some first rudiments of religious knowledge, on which it is the province of revelation to shed a full and abundant illumination.

### *Natural Theology necessary as the Basis of Revelation. Opposite Views considered.*

WHATEVER difference of opinion may prevail as to the extent to which the inferences of natural theology may reach, or the limits by which they must be circumscribed, all rational inquirers on these topics, I should conceive, would agree in admitting at least *some* first elements of belief in a Deity, however imperfect and insufficient, as established by natural reason. And it appears equally clear, that, not only any notion whatever of a revelation, but even any statement or proposition of further religious truths beyond the primary doctrines of the existence and perfections of the Deity, must, from the nature of the case, *presuppose the truth* of those primary doctrines, and be actually based upon the evidence of their truth.

If, again, we look to the establishment of the *Evidences* of revelation, we must consider the essential bearing which our notions of the Divine attributes have upon them. This is not the place to enter upon the discussion of those evidences. But in general it will be apparent, on a moment's consideration, that the most material part of the argument for revealed religion, (if it is to be supported on the ground of miraculous testimony,) essentially turns upon our *previous* admissions with regard to the Divine attributes. From these alone do we obtain those preliminary ideas, which confer sufficient probability on the notion of a disclosure of the Divine will by supernatural interposition, to render the question fairly susceptible of an appeal to evidence and testimony: a portion of the reasoning at once most essentially important, yet very commonly overlooked: and thus left open and defenceless, to the attacks of scepticism. Thus it becomes peculiarly important to scrutinize the extent to which natural theology can legitimately supply those considerations of antecedent probability, which are absolutely necessary before we can entertain the question of *testimony.*

These considerations seem to me so plain, from the mere nature and reason of the thing, that it would be hardly necessary to dwell upon them, were it not that there are those (as we have already, in some manner, noticed,) who, in the strongest professions of a desire to support religion, have systematically disparaged the claims of natural theology, and decried the use of human reason in the investigation of Divine truth.

It is singular to notice the inconsistency of the objections entertained against natural theology by different parties. Some complain of it as going too far; others, as not going far enough. One party object to it as presumptuously usurping the place of revelation, encouraging the self-sufficiency of intellect, and setting its followers above the instruction of the Word of God: as tending to lower the value of the mysterious truths of revelation, and to favour the rationalizing system of interpretation. Another party affect to despise natural theology and its physical proofs, as grovelling among mere objects of sense, and as restricting our contemplations to material things: as defective in its doctrines, leading us to no moral governor of the world, inculcating no moral responsibility, nor future state, and thus practically differing little from no religion.

It is decried, at one time, as vain and weak; at another, as arrogant and dangerous: held in contempt by those who are ignorant of its nature, and dreaded by those who tremble at the dawn of truth and free inquiry, for their own dogmas, whether of atheism, fanaticism, or orthodoxy. Thus are parties so discordant, unconsciously leagued in a common cause; and we hear the language of objection and disparagement so precisely the same in the mouths of the orthodox and the infidel, of the enthusiast and of the atheist, that it is often impossible to distinguish to which class the objector belongs.

Among the several opinions entertained in opposition to the claims of natural theology to be the *indispensable* basis of revelation, the only one which I have seen supported even by the show of argument, or recognising in any degree the necessity of rational evidence, is, in substance, as follows*:

Suppose a set of men who had arrived at no belief in the truths of natural theology: suppose a person claiming to be a teacher of revelation to appear among them working miracles: would not, it is asked, those miracles prove rationally to such persons that the individual was commissioned from *some superior power or being*, and thus when his system was unfolded, and when it exhibited to them the doctrines commonly included in what is called natural theology, they would then, on rational evidence, believe those truths along with the others revealed.

It must be recollected that the question is wholly one of *evidence*. The case supposed is imagined only to represent more forcibly, not what is or would be, but what *ought to be*, the correct course of reasoning. It may be entirely admitted that the parties in question *might embrace* the truths propounded to them; this they might do on the mere strength of the teacher's character, authority, and influence over their minds, without any miracles, or even evidences, at all. The question at issue is, whether the miracles, under the circumstances supposed, would afford strict logical *evidence* of the teacher's commission from *some* superior being.

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* See Irons *On Final Causes*, p. 162. This point, in fact, constitutes the whole strength of the author's argument.

Now, in order to this, it appears to me manifestly essential, that not only the existence of some such being should be, in the first instance, recognised, but also the power of any beings, however superior, to suspend the laws of nature, (which, to any one versed in physical inquiries, would be the most difficult point of all,) and further, that this would be done for the purpose of conveying a revelation; which again must presuppose the power and will of such a being to make disclosures of religious truth; all this must be believed on good evidence before the teacher's claim could be rationally received; in other words, it would imply a natural theology even of a very precise kind.

The case supposed is, indeed, almost an impossibility; since we can hardly conceive a people advanced enough to reason as the hypothesis requires, who had not attained to some idea of a superior power or powers; to whose influence (embodied*, perhaps, in the person of the teacher,) they would directly ascribe the miracle. But even in this case, it is very likely that the result would be far from that of convincing them by *evidence* of the truths propounded. The supposed working of the miracle would not, of itself, be any proof of the *existence* of a superior being; it would most naturally and rationally be set down as merely an extraordinary event, which, though not in the present power of the witnesses to explain, would most probably be accounted for by some future discoveries in nature; or would be, perhaps, more properly ascribed to some hidden knowledge and superior skill possessed by the teacher, who really or apparently wrought it.

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* Is not this view confirmed by actually-recorded examples? See *Acts* viii. 10; xiv. 11; and xxviii. 6.

But those who have maintained this view of the matter have gone on to contend, that, in fact, there are other sources than those of the reasonings called natural theology, from which a notion of the Deity and his attributes may be acquired. They have traced such a notion and belief up to what they consider a natural constitution and tendency of the human mind, an ultimate conviction of our souls; a principle of belief, in fact, innate; and manifested in the universal consent of mankind.

On all such views I have merely to observe, that, entirely allowing the *fact* of such general persuasion, and that it most commonly *is* nothing more than the undefined yet powerful kind of impression spoken of, yet to assume that it is therefore an *innate* or ultimate principle of our nature, is to beg the very question at issue; the entire object of discussion in natural theology being to ascertain whether this conclusion cannot be logically analyzed, and the grounds of this persuasion investigated by tracing the legitimate course and order of our convictions from the elements of our knowledge of the natural world, through the inferences of order and adjustment, up to that of design and intelligence, and from the universality and unity of design up to the unity of designing intelligence, from the immensity of its plan to the infinite power of its author; from those beneficial arrangements which we can recognise, to his Providence; from the inexpressible beauty and harmony of natural order, to the perfections of the great Source of it.

It seems, in fact, that to a confusion of views between the admission of the existence of certain impressions and feelings in our minds, and the process of investigating them on the grounds of exact argument and evidence, may be traced many of the singular speculations occasionally obtruded on the world as profound metaphysico-theological reasoning. Many writers on these subjects seem not to keep steadily in view which course they desire to follow, whether to *appeal* to feelings or to *analyze* them.

### *Rational Evidences of Faith.—Various Opinions considered.*

It is of course perfectly notorious that the great mass of those who adopt even the purest form of faith, adopt it without any rational examination of evidence, whether of natural or revealed truth. The appeal to natural impressions, however just in itself, throws no light whatever on the real question at issue, which concerns not *what* men *are led* to believe, but the rational *evidence on which* they believe it. Not what are the natural impressions, but *how* and *why* they should be impressed. And this more especially with reference to the analysis of *our own* convictions, and the searching inquiry which we ought to make into the grounds of our own belief, with all the light and information we possess; in order that, on the most vitally important of all subjects, these convictions should be guarded by none but the most secure arguments, and repose on none but the most unassailable foundations.

But the majority of those who decry this kind of inquiry, do so upon a more specific ground of faith. They, in fact, discard all idea of reasoning upon the subject. They look to a peculiar kind of impression upon the soul; neither to be reasoned upon nor resisted. In this their whole apprehension of the Deity is made to consist. Thus all philosophical proof is useless, and even dangerous; all exercise of the intellect on such a subject is at variance with the demands of a true faith. With those who entertain such persuasions, it is of course vain to dispute. Discarding reason, they are insensible to fallacies in argument. But should any be disposed to pause before wholly delivering themselves up to such views, they might consent to be reminded, even upon an authority which they must peculiarly admit, that "he who cometh to God must believe that *He is*, and that He is a rewarder of those who diligently seek him*."

Some, again, in an elevated spirit of religious devotion, have contended that none but the true Christian can derive any profitable evidences of the Divinity from the contemplation of his works; that he alone whose soul is enlightened, purified, and elevated to God by grace, is able to perceive or to enjoy the manifestations of his existence and presence in nature. Thus they do not altogether condemn the study of nature; but they maintain, that when the believer turns his thoughts to the proofs of the Divine perfections in his visible works, it is solely in obedience to the exhortations of Scripture; and valuable only as an exercise of the spirit of humble adoration inculcated in the Bible; and to be carried on with an entire submission to the language of Scripture relative to physical subjects†. But though it is undoubtedly true, that the spirit of Christianity does thus elevate contemplations which would otherwise be restricted to the level of mere conclusions of the understanding, and render practically fruitful what would otherwise be the barren speculations of reason; though a pure faith alone can add piety to philosophy, and irradiate with joy and hope the contemplation of God in nature; yet it is, at the same time, equally true and necessary that those conclusions in the first instance be separately attained; that those speculations, however barren in themselves, be first established on their own ground; that there must first be a philosophy to afford the external evidences of faith; and an independent investigation of nature to furnish the means of tracing those indications of the Deity*.

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* *Heb.* xi. 6.

† See Note M.

Opinions of this kind often take their rise in a zeal for certain particular views of religion, considered to be inculcated by revelation; but this with some diversity of principle.

One party, to exalt the work of grace and the teaching of inspiration, would reject all conclusions of reason; and in accordance with the peculiar scheme of spiritual illumination which they deduce from the Bible, would annihilate the carnal evidence of depraved sense to vindicate the majesty of Divine truth.

Another school, to uphold certain theories for which they claim the exclusive title of rational interpretations of Scripture, on quite opposite grounds, would keep natural theology out of sight, in order to make revelation little else than a declaration of the same truths.

Both parties seek to uphold the credit of Scripture according to the peculiar views they take of it. The one by rejecting natural reason to exalt faith; the other by making reason everything, but explaining away revelation into an identity with it†.

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* See Note M. † See Dr. Turton's *Natural Theology*, p. 207.

To these may be added another school, to whose views we may here briefly advert.

That system of theology which reduces all belief into an act of obedience to the authority of the Church, when thoroughly and consistently followed out to its logical consequences, stands within itself complete and unassailable. Its advocates, therefore, can fearlessly afford to give full scope to physical investigation. Raised far above all appeal to reason, and not condescending to rest its claims on argument, its infallibility cannot be in the slightest degree impaired by any philosophical inquiries, even if they should terminate in conclusions the most hostile to the so-called evidences of revelation.

A system founded on such principles cannot be susceptible of any hostility towards scientific pursuits. And as they confessedly do, to a great extent, afford support to natural theology, they may even be made useful auxiliaries; they may afford occupation to the restless activity of the human mind, and thus withdraw men from inquiries of a more dangerous nature into things spiritual; besides being susceptible of indirect application in the illustration of religious truths.

Such would be the state of the case where these principles were fairly followed out. Such, accordingly, *is* very much the feeling and practice in the Roman Catholic Church*.

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* For some exemplification of this see the *Dublin Review*, No. IV., and an able article in No. VI., where the wonders of science

I have spoken of such a system *if consistently* followed up. Now, pretensions of the same kind are maintained by a party among ourselves at the present day;—who, with all the assumptions just described, fall short of their *consistent* consequences. They refer to a religious authority which discards reason, yet is afraid to claim infallibility;—which rejects human means of conviction, yet does not pretend to divine powers;—which affects to command submission, yet dreads the agitation of argument. Hence in their eyes all scientific investigation is regarded with the utmost suspicion and hostility; all inquiries into physical causes are either profane intrusions on forbidden ground, or empty delusions of blinded self-conceit, and of the most fearful tendency. They must therefore be discarded, or rather, all science must be so modified as merely to hold a subordinate place in a great mystical system, and be interpreted wholly in accordance with certain high principles on which that system is founded; if viewed otherwise, it is dangerous and profane.

Such appears to be the nature of their ideas on the subject, whenever, through the obscurity which envelopes the writings of this school, we can catch a glimpse of their meaning. Thus, we are told, "In history, morals, poetry, legislation, *philosophy*, language, *physics*, religion,—heaven and earth, a body

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are ingeniously turned to supply an argument for the admission of mysteries, as in transubstantiation.

of clay and a spirit breathed into its nostrils by the life-giving Spirit, stand over against each other, and whoso lifteth not up the earthly to the heavenly will bring down the heavenly to the earthly. 'Homer,' says even a heathen, 'transferred human things to the gods; would he had rather things divine to man*!' If the body be not spiritualized, the soul will be carnalized†."

It will be needless to comment on the entire confusion in which such mysticism involves all rational evidence. Yet a system not claiming *entire* infallibility, cannot surely dispense with *some* appeal to such evidence, if it really involve a reference to Divine inspiration.

To an ordinary inquirer of plain sense and honest purpose, a professed belief in revelation, as such, it would seem, must, in any sense, imply a reference to its alleged evidences, examined by reason; and their testimony and its application must presuppose the existence, attributes, and providence of a revealing Deity, already known independently of revelation, and therefore discovered and believed by the exercise and conviction of our unaided intellectual faculties employed in the study of his works.

In any way, then, this confounding together the respective provinces of reason and of faith leads men into equally manifest error and inconsistency; —they must fall into a palpable "petitio principii," on the one hand, or else rush into fanaticism or bewilder themselves in mystical superstition, on the other.

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* *Cic. Tusc.* i. 36.

† Dr. Pusey's *Sermon on the Fifth of November*, Oxford, 1837.

Meanwhile the enemies of the truth are not backward to perceive the fallacies in which each party thus involve themselves; and thus have only to borrow their language and assume their tone to disguise their insidious attacks upon all revealed religion.

### *Independence of Scientific and Revealed Truth.*

To those who would wish to see the edifice of religious truth reared upon a solid and unassailable foundation, it will surely not seem unimportant to dwell on the necessity of a due order in the disposition of our proofs; of making the belief in revelation depend on the secure support of natural theology; and this again on the truths elicited by inductive science; and with this view carefully to distinguish the nature of scientific proof from that of religious belief. And this is the more necessary, since there are not wanting those who so far confound all such distinctions, as not only to supersede natural theology by revelation, but even go a step further, and look to the Bible as a source of instruction for the truths of natural science; that is, for those very truths on which natural theology rests, and on which consequently its own evidences ultimately depend. There are some, indeed, who have professed to found entire systems of philosophy wholly on the basis of inspired authority; others who do not go this length, at least from the peculiar view they adopt of the character of the inspired writings, would mix up their authority with that of experimental proof, and imagine either that the one or the other can receive an accession of evidence; that that which is divine can be made more sure by human confirmation, or that which has the evidence of sense more certain by the appeal to authority*.

Let us then look at the general distinction between the ground of *science* and of *faith*. *What is* scientific inquiry? And what are the objects we have in view in pursuing its investigations? Is not such inquiry *necessarily limited* to questions of fact, and such discovery of laws and causes as we can legitimately deduce by strict *reasoning* upon those facts? Are not such objects *exclusively* those of *truth as discoverable* by the *sole* use of our reasoning faculties? If then we either adopt *any other standard whatsoever in such questions*, or pursue our inquiries by a reference to any other authority whatsoever than solely that of inductive inference from observed phenomena, we are deviating from the proper line of scientific inquiry; we are renouncing the principles of the inductive philosophy altogether.

Yet that which is no guide in matters of science, may be the highest standard of truth in reference to matters which properly belong to its province. The truths of revelation, received upon their proper moral evidence, evince their divine excellence when directed to the high and peculiar ends for which they are designed. But the moment we so entirely mistake their object as to apply them to the purposes of philosophic instruction, our inquiries lose every characteristic of rational or consistent investigation.

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* See Note N.

Scientific and revealed truth are of essentially *different natures*, and if we attempt to combine and unite them, we are attempting to unite things of a kind which cannot be consolidated, and shall infallibly injure both. In a word, in physical science we must keep strictly to physical induction and demonstration; in religious inquiry, to moral proof; but never confound the two together. When we follow observation and inductive reasoning, our inquiries lead us to *science*. When we obey the authority of the Divine Word, we are not led to *science* but to *faith*. The mistake consists in confounding these two distinct objects together; and imagining that we are pursuing science when we introduce the authority of revelation. They cannot be combined without losing the distinctive character of both. If faith is to be our guide to natural truth *at all*, it must be *wholly* so. If we appeal to its authority at all on points of natural science, we must adopt it as our sole authority; we must renounce all guidance of reason, all appeal to the evidence of sense. If we are to reject the results of observation and the evidence of our reason on one point, we in fact give up the *principle* of making them our guides to truth: that is, we give up the principle and ground of all experimental knowledge; of all independent search into the works of the Creator; and by consequence, of all rational proof of his existence, and thus ultimately of his revelations too.

To the connexion of physical causes and the order of the material creation we appeal for the evidences of the Divine existence and perfections. Until we have proof of a Deity, we can have none of a revelation. Upon the proofs of natural religion those of revelation essentially depend. To give the latter, then, *any share* whatever in determining the former, is to make the premises depend on the conclusion. The evidences of natural religion are derived from physical knowledge. To assume, then, the authority of Scripture as in the slightest degree applicable to prove the order of physical causes and the laws of the material creation, is to make revelation the basis of *natural* theology,—or, in other words, to beg the question, to vitiate the whole argument, and to destroy all rational evidence. Yet it would really seem that there are some who do not see the contradiction of such a course;—of believing in revelation without first believing in God; of receiving a doctrine as declared from Him before we prove that He is. For such is precisely the proceeding of those who look to the Bible, as such, for instruction in the science of nature. They do not seem to perceive that the arguments of natural theology must, from the nature of the case, be *independent* of the truth of revelation; and that, consequently, the evidences of *physical truth*, on which the former wholly depend, must be, in like manner, sought for *independently of the authority of Scripture.* To allow the opposite course is to entangle the chain of reasoning in hopeless confusion, and to make the whole evidence of religion an argument in a circle.

This *essential* independence of Scripture and physical science is the more necessary to be attended to, because though it has not been overlooked by some writers, yet it has not been generally maintained upon its *right basis.* And it appears, in reference to some floating opinions of the present time, peculiarly needful to insist upon this distinction, so essential to the stability of the evidences of natural theology, and, by consequence, to those of revelation also, yet so strangely misconceived, and practically denied, by some parties at the present day.

The observations which I have thus far made have referred to any, the most general, notion which can be entertained of a revelation of Divine truth, in whatever we may imagine it to consist, or by whatever means conveyed. They will, however, apply with equal force when we proceed to consider the nature and mode of such communications of Divine truth in a more precise sense; when we advance to the examination of that particular view of revelation which consists in the adoption of the volume of the Bible, as its sole authentic record and depository.

And this view of the subject naturally and immediately brings us to the examination of a point of considerable importance bearing upon the connexion of natural and revealed truth, and which arises out of the more particular notion of revelation to which we are now referring;—the question of certain real or alleged contradictions between the results of physical investigation and the language of the Bible, and the attempts which have been made to reconcile them.

Among those who admit the general truth of the foregoing remarks,—who allow, when it is distinctly put to them, that the laws of nature, in order to become evidences of a Deity, must be established on independent grounds, there are yet those who feel difficulties with regard to certain Scriptural expressions. Many who fully acknowledge, when it is pressed upon them, the fallacy of making the truth of Scripture the basis of its own evidence, yet still feel considerably perplexed by alleged *discrepancies between science and revelation.* They still seem to think the cause of religion in danger, unless the language of all parts of the Bible can be brought into exact accordance with the facts and laws discovered in the natural world, and would thus hazard its entire credit upon the chance of contradiction which may arise at every fresh disclosure of physical discovery.

In any point of view, this is certainly to evince a most disparaging estimate of the evidences of revelation, if not to cast a direct reflection on them, and betrays a singular misconception of its spirit and object. Those who most fully and rationally appreciate the evidences and nature of Christianity, will be the first to perceive and to allow that its stability can be in no way injured by the pursuit of physical truth, or the existence of those contradictions so much referred to, between the letter of the Scriptural representations of the order of creation and the visible existing monuments of the changes which the earth's surface has undergone, before the date of the human race*.

We might, indeed, infer this even upon the *general* truth of the foregoing remarks. For we have thus seen that to suppose revelation a guide to physical truth would involve us in a *petitio principii.* It *cannot* possess any authority on such points without vitiating the whole train of evidence of religion, both natural and also revealed.

Hence, then, it follows by direct inference, that if any representation in Scripture be at variance with the truths elicited in the natural world, such discrepancy cannot be really injurious to the maintenance of the proper spiritual authority of revelation; nor can it in the least vitiate its claims as a disclosure of moral and religious truth.

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* See Note O.

Indeed, the existence of such contradictions may serve to warn the inquirer against arguing in a circle, as reminding him that revelation *ought not* to be appealed to for physical truth, since he thus perceives that in these instances it cannot.

### *Attempts to combine Philosophy and Scripture.*

THE slightest consideration of the subject in accordance with the principles already laid down, might suffice to any unprejudiced and reasonable inquirer.

Still, however, there are some who cannot feel satisfied; and under a confused impression which they entertain of the relation between physical and revealed truth, are impatient of even any apparent contradiction between them, and anxiously catch at any means of reconciling them. It will, therefore, be desirable to make a few further remarks on these discrepancies, and attempted reconciliations.

The history of past ages supplies us with familiar examples of the spirit in which such questions were viewed. We well know how the letter of religious authority was appealed to in opposition to the discoveries of astronomy. But though these are not the very same points which occupy attention at the present day, yet the principle involved is identically the same. Whether we are to adhere to the letter of Scriptural representation in opposition to the testimony of inductive research, or whether it is safe, rational, or consistent with an enlightened and well-grounded faith, to stake the reception or rejection of Christianity on the credit of these particular expressions, is still the question.

Without dwelling on the instances of the wild speculators of past ages, who deduced physical systems on the authority of what they considered the doctrines of revelation, and framed schemes of philosophy on principles which essentially destroyed its claims to being philosophy, we may find that, in fact, even at the present day, there are not wanting disciples of such a school, nor even among the professed followers of science, those who seriously construct and maintain such systems, which are, in fact, neither systems of faith nor philosophy, but a combined perversion of both.

But it will neither be necessary nor pleasing to dwell on such speculations. Even among those who are most ready to allow their unreasonableness, we may discover many who entertain views which are the very same in the *principle* on which they are framed.

To adopt the very notion of expecting or wishing to find in Scripture any confirmation of the results of inductive science,—to attach importance to accordances between the descriptive or poetical language of the Bible, and the conclusions of philosophy on the one hand, or to consider the want of such accordances as any objection on the other,—to seek to prop up the credit of the sacred writers on the verbal coincidences with physical results, or think it endangered by the violation of such coincidence; all this is, in fact, the very same thing in principle as to make revelation the guide to philosophy. It is to imagine the letter of its language the proper evidence of physical truth. The very same mistaken principle of reasoning then is chargeable on those who construct systems of philosophy out of the Bible, and those who attempt to force its language into accordance with philosophical results. The very same misconception of the distinct nature and grounds of religious and scientific truth is evinced equally in the speculations of the Hutchinsonian school of a past age, and those of the Bible-geologists of the present day.

It may, indeed, be true with regard to the system of gravitation, and the motion of the earth, that it is not now thought necessary to enter into the discussions of Biblical criticism to find support for them, nor, on the other hand, imagined that the admission of them is dangerous to the authority of faith. Still the very same *principle* has been and still is adopted by a great number of writers, with regard to the facts of geology and the account of the creation as conveyed in certain passages of the Old Testament. Whether the particular point in question be the nature of gravitation and the production of light, or the motion of the earth and stability of the sun, the speculations thus raised are still only exemplifications of the very same spirit which has dictated similar questions connected with the results of geology and physiology, so much agitated at the present day. And the right view of these, must alike be dependent upon the very same rational considerations which are now generally allowed to apply, in the more obvious cases respecting the system of the world.

### *Distinct Objects of Revelation.*

EVEN in the most general point of view, and without at present entering upon any more precise distinctions, whatever may be the peculiar view entertained as to the nature of a Divine revelation, it must assuredly be allowed that its object and aim must be essentially distinct from the inculcation of physical truth. Upon almost any conception which may be adopted of those objects, we ask what possible reference can the physical expressions used by the sacred writers bear to the religious truths which it was their object to communicate?

Common sense surely suggests the rule, that what is but incidental in any case, should be fairly viewed apart from what is the main object. For example, the character of a *history, as such,* is in no way compromised, though the author may happen to use terms of *art* incorrectly. The conclusiveness of *scientific* research is in no way impaired by inaccuracies of *style.* In many of the most famous masterpieces of design, the artist has fallen into incongruities and anachronisms; yet the most acute critics are foremost to admit that this in no degree spoils the force and beauty of the painting. One and the same reason evidently applies in all these cases: viz., that these defects occur only in what is but *incidental* to the design, and *distinct* from the main object in view.

To expect to find the truths of science declared by revelation, or to feel a difficulty when the forms of expression adopted by the sacred writers are contradicted by the facts elicited in nature, is as unreasonable as it would be to expect to find the theorems of Euclid enforced by Act of Parliament; or if in the statutes we should chance to meet with any expression not mathematically correct, either to condemn Euclid as illegal, or to think it necessary for vindicating the majesty of the laws, to resort to all the arts of special pleading for explaining away the discrepancy. Scriptural geology is as preposterous in principle as statutable geometry. By the same rule we ought to criticise poetry on the grounds of metaphysics; and establish the processes of chemistry by the precepts of rhetoric.

Yet to allow that these are absurdities, is no disparagement either to law or mathematics, to poetry or to metaphysics, to chemistry or rhetoric, considered in themselves. It is only in the attempt to *combine* them that the absurdity arises. Each in their proper way, and directed to their proper purposes, are excellent; it is only when we apply the one for the purposes of the other that we act absurdly, both are perverted, abused, and injured.

My object in these remarks has been rather to point out and discuss the *great principle* of the question than its details; to place the whole subject on what I conceive to be its *right ground*, rather than to follow up any minor points connected with it. And it is chiefly as conducting their argument upon those *details*, instead of looking to *principles*, that I find fault with most writers who have treated on the subject. Even if we should allow that, in some instances, the attempts to reconcile the letter of Scripture with the facts of geology, have been ingenious and plausible, and supported with considerable skill and learning, still the objection which I entertain against them would remain in full force, being directed against the radical defect of their *first principle;* the idea of seeking for such an accordance at all, and the utter improbability that it should have been contemplated in the delivery of the Judaical law, or in the Mosaic history.

### *Low Views of Revelation.*

SUCH considerations, it might be hoped, would satisfy any dispassionate inquirer. But it is unfortunately obvious that a variety of causes interfere to render many professed followers of Christianity insensible to the reasonableness of these views. Adopting their creed blindly from education, custom, or party, too many hold their religion only by a most loose and uncertain tenure, and are lamentably confused in their notions of its nature. Hence they dread a formidable shock to Christianity in every physical discovery; and in the obscurity which surrounds them, imagine danger to the truth in every exposure of error. Insensible to the real strength of their position, they live in groundless alarm for its security; and accustomed to cherish faith in ignorance, they apprehend, in every advance of knowledge, the approach of the enemy of their salvation.

Too many nominal Christians entertain only the most miserable idea of the nature of the gospel they profess to believe; their only notion too often consists in a confused general impression of a certain sacredness in Scripture, which produces little effect beyond that of making them afraid to enter its precincts, and search its recesses for themselves, and yet more fearful lest its sanctity should be invaded by others.

And their dread of openly encountering any contradictions, and their anxious desire to shelter themselves under even the most frivolous explanations, if it does not betray a lurking distrust of the proper evidences of their faith, at least evinces the lowest and most unworthy conceptions of the spirit and meaning of the Bible, and an almost total absence of due distinction between the design and application of the several portions of which it is made up.

That such misconception should prevail is indeed a lamentable, but not a surprising instance of the liability of human nature to misapply the best gifts, whether of Providence or grace. And its influence has been unhappily cherished and confirmed by the prevalence of those theological systems which have dictated the practice of *literalizing* upon all the expressions of the sacred writers; so that the magnificent imagery of the finest passages of inspiration is reduced to the lowest standard of verbal dogmatism; and minds incapable of appreciating the Divine sublimity of those descriptions, think to add to the evidence of their truth by a forced and unnatural perversion of their meaning.

With others again, the sincere, but (as we must consider it,) misguided spirit of religious fanaticism, produces similar effects. Blinded to all but the internal light of his spiritual impressions, the enthusiast will always entertain a deeply-rooted and devoted hostility against any such distinctions as those here advocated. Maintaining the literal application of every sentence, every syllable of the Divine word, he rejects, as impious, the slightest departure from it. Human reason, along with all science which is its offspring, is at best carnal and unsanctified; and should any of its conclusions be advanced in contradiction to the letter of a scriptural text, this completely seals its condemnation as absolutely sinful, and equivalent to a rejection of revelation altogether.

In such cases we may most readily make every allowance due to sincerity, however mistaken. But there are other instances in which, unfortunately, little claim to such indulgence can be found. There are some who join most vehemently in the cry against science in general, and geology in particular, as dangerous to religion, *upon no sincere grounds of religious conviction.*

Their adoption of a certain form of faith is dictated by motives of *expediency,* and the mere value of its practical effects on society. Not themselves recognising its claims as founded in *truth,* they uphold the established creed, as well as all received errors popularly engrafted upon it, as a convenient and effectual instrument for securing the influence of practical restraints on the multitude. Hence they condemn all inquiries which may come into collision with any portion of the popular belief; and against the agitation of any question which may shake established prejudices, or suggest any distinctions in the application of Scripture, there is an immediate and indiscriminate cry raised that they unsettle men's minds, and are heretical doctrines of a most dangerous tendency, and such as will weaken and efface all sense of religious and moral obligation.

But even among the best men and most sincere believers, there exists too often a sort of dread of meeting such questions in a strictly *honest* frame of mind. Those who have the most conscientious regard for truth, in everything else seem to think it dispensed with in supporting the cause of religion.

And while they earnestly condemn those who in former ages could justify the "pious frauds" introduced in support of the received faith, are yet themselves influenced by the very same spirit only in a different form, in dreading the dissemination of knowledge if even imagined to be at variance with established religious tenets.

The one party seeking to support religion by the propagation of falsehood, the other by the suppression of truth, both agree in treating truth as if it were falsehood, and thus give its enemies the fairest ground to think it so.

## *Geological Interpretations of Scripture.*

FROM what we have already seen of the invaluable evidence supplied by geology to the great truths of natural theology, and thence to the foundations of all religion, we shall be prepared to allow its high importance. We must, further, have perceived, in going through even the mere outline of that evidence, the positive inferences which it involves, and on which it is indeed founded, as to the gradual introduction of the present order of things, and the existing species of organized beings, out of previous forms of existence. And it is manifest that this is, apparently at least, in direct opposition to the literal and obvious sense of the representations given of the process of creation, at once, out of darkness and confusion, at a recent epoch, given in several passages of the

Hebrew Scriptures. And there are not wanting those who hold forth the discrepancy as a triumph to scepticism, and as giving the death-blow to the veracity of the Bible, and to the authority of the Christian religion*. On the other hand, we have considered the too general condition of even the professedly Christian world, as to its degree of religious information.

Such being the state of the case, and, from a variety of motives, so prevalent the apprehension that an examination of the structure of the earth would undermine Christianity, it is not surprising that, in the infant state of geological science, its advocates should have been extremely cautious in their mode of broaching the unwelcome truths: and should have propounded a variety of solutions of the difficulty more or less plausible. Whatever may have been the prudence of such a course, when the science had to struggle with the difficulties attending its earlier advance, whatever fears it might then have to entertain from the hostility, whether of orthodoxy or fanaticism; it has now arrived at such strength and maturity as to render all such expedients (under any circumstances but doubtful) wholly unnecessary.

It is, therefore, a matter of sincere regret to every lover of truth, still to see some excellent writers keeping up this temporizing system, when on every ground it would be so much more worthy a course boldly to front the difficulty, and avow the contradiction in plain terms; but instead of this, we observe them exerting their utmost ingenuity to elude the contradictions, either by disguising the *facts*, or glossing over the *words* with the most flimsy interpretations.

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* See *Popular Geology subversive of Divine Revelation*, &c., by the Rev. H. Cole. London, 1834.

It would, indeed, appear extraordinary, that the notion of looking for modern science in the ancient Scriptures should be found satisfactory to any person of ordinary sense, were it not that we discover many causes which tend, in this case, to blind the clearest perceptions. The subject, when simply and calmly considered, is plain, and hardly open to misapprehension; but men cannot be brought to consider it simply and calmly. Yet what mode of proceeding can be more irrational? passages are quoted from writings produced ages before any of the facts of geology were understood; and now that they are known, the critic sets about to make those passages speak the language of modern science!

These writings constitute the delivery of a religious system to the Israelites; and now men try to make them supply astronomical and geological instruction to Christians!

In all this the *object* is so palpably mistaken, that were the suggestions of the critic ever so happy, and the expositions themselves ever so luminous and natural, we could not attach any serious weight to them. But when we come to observe, in the majority of such cases, how entirely gratuitous are the theories, and how miserably strained the verbal interpretations, which are necessary in order to effect the accordance, the whole attempt must appear yet more manifestly futile. For let us only dwell for a moment on the nature of these interpretations.

When a commentator of the present day sets about to put a particular interpretation on a passage in an ancient author, he may, upon an examination of the critical sense of the words, and the construction of the sentence, make out a meaning which to *him* is plausible, and in itself consistent. But there is another question entirely distinct from this, too often quite overlooked, but essentially impotant to a true interpretation: viz., whether it is *probable*, from concurrent circumstances, that this was the sense, in point of fact, *actually intended by the author*. It is one thing to make out such a sense as, to *our* apprehension, *the words may bear*, quite another to infer that this was the sense *really in the mind of the writer*.

Now, in the geological interpretation of Scripture, this consideration seems strangely overlooked. Allowing for a moment that the *verbal* construction, or the proposed sense, is one which the passage *may be made to bear*, where is the probability that it was the *intended signification?*

Supposing it granted that by some critical process these descriptions may be brought to take a verbal sense, accordant with the facts elicited by geology, still the question is, Can we soberly bring ourselves to conceive that this was the sense actually *designed and contemplated* as that in which the words were to be understood? and *if it was* NOT, *what is the coincidence worth?*

If but a moment's consideration be bestowed on the circumstances of the case, can it be seriously imagined that the delivery of the Judaical law was really *intended* to embrace the doctrines of geology, and this too under the guise of expressions which, in their obvious sense, are directly contradictory to those doctrines? Is it on any ground conceivable that such a purpose could have been in view in the delivery of any divine revelation? and much less in that vouchsafed to the Israelites. And if it were, could any method be devised more adverse to its accomplishment? For we are thus driven to suppose a design of revealing certain truths by effectually concealing them: since we know that, in point of fact, the hidden sense was not disclosed: and from the time of Moses downwards, no one has ever imagined the secret meaning of the description till the present day, and when disclosed it affords no instruction, since it cannot be so much as understood till the facts have been learnt from geological study, and when they have been, it is superfluous.

### *Representation of the Creation in Genesis.*

WITH a total disregard to all such considerations as those last adduced, we find a certain school of interpreters of Scripture continually labouring to make out some sense of the terms in which the creation is described in the first chapter of Genesis, to make it square with truths which could not have been in contemplation in the delivery of the narrative; and exhausting every resource of critical skill to force the language of the representation into accordance with facts now attested by the organic remains of former orders of existence, which could not have been intended to be represented.

Formerly the geological interpreters were engaged in taxing to the utmost the powers of philology, to convert the six days into periods of millions of years; notwithstanding that they are described precisely as alternations of day and night; and that this is absolutely implied is the very purpose of the whole description, since the six days must manifestly be taken in the same sense as the seventh. On the other hand they had to exert not less ingenuity to make the order of geological epochs accord with these periods. This scheme, however, was at length found to answer the views of neither party. The theological critic could not admit such strained and dangerous interpretation, and the advance of geological research soon showed every one that there were, in fact, no such marked epochs in the successive formations, or in the introduction of the races of organized beings.

At the present day another view has received the sanction of some eminent names, and has obtained considerable currency. It has been conceived that the narrative in Genesis is intended to describe separately, in few words, (in the first verse,) the original creation of all things; after this the indefinitely long history during which all the changes indicated by geology took place, is passed over in silence; a new period then commences, which may be understood according to the literal order of the narrative, provided some latitude be allowed in the interpretation of the terms. A state, if not of darkness and chaos, yet at least temporary disorder and obscurity, was produced; and the work of the existing creation, or at least reproduction and arrangement, then commenced, and was continued as described in the following part of the chapter, and perfected in six natural days*.

Now, without entering upon the grounds of such an interpretation, I will merely observe (looking only to the verbal construction,) how very wide a latitude in the meaning of words must be allowed before we can affix such a sense as this to a representation so precise and circumstantial; and every reader of the slightest taste and discernment will surely at once exclaim against it as totally at variance with the obvious tenour of the whole style of description, and destructive to the matchless sublimity of the terms in which it is conveyed. Those to whom such a version can appear satisfactory, who can believe that this is what Moses really *intended* to say,—must entertain notions of the use and application of language of a kind which I cannot appreciate. It seems to me only necessary to turn for a moment from the paraphrase to the plain text, from the critical refinements to the simple language of this magnificent composition; from the philosophical theory to the obvious tenour and train of this most sublime imagery, to be fully satisfied as to the meaning intended to be conveyed: a meaning totally distinct from anything philosophical, or bearing the most remote reference to any anticipations of geological discoveries.

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* See Note P.

Another view of the matter has been proposed by an eminent philosopher, which amounts to an admission that it is impossible at the present day to fix *any* certain meaning on compositions of such antiquity, and so entirely destitute of all elucidation from contemporary writings, as the Mosaic records*. Such an idea, of course, has called forth no small censure. But surely even this is scarcely more destructive to all definite interpretation than versions like those we have just mentioned;—such an idea, honestly avowed, is surely preferable to the indirect introduction of principles which, fairly carried out, may enable us to fix upon any given passage, any required sense.

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* See Babbage's *Ninth Bridgewater Treatise*, chap. 4 and 5.

I am assuming that the inquirer and interpreter are both sincere seekers of truth. If indeed the object be, instead of discovering truth, to say something plausible to satisfy prejudice, and avoid giving offence to popular belief, there is no limit to the inventions which men will not readily swallow down, if only made palatable to their prepossessions.

### *Admission of Contradictions.*

Let the appeal be made to any reader of ordinary sense, not prepossessed in favour of a theory, and it seems to me impossible that he can understand the description, (whether in the shorter form of the Decalogue, or the more expanded of Genesis,) considered simply as to its terms, otherwise than as presenting a magnificent picture of Almighty power, and embodying the representation of one, original, entire, simple, universal act of Divine interposition, at once, and for the first time, framing and calling into being and operation, out of previous universal darkness and confusion, the heavenly bodies, as well as the earth, and all the races of organized beings upon it, in the actual progressive stages assigned to the six days specially described as literally such. Even if we allow the separation of the first verse as a distinct account of an earlier creation, (which, to my apprehension, seems a very forced dissociation of the members of a sentence,) still, in the second verse, the entire tenour of this unrivalled imagery seems incapable of conveying any other impression than that of the total absence of all organized existence, and the prevalence of universal confusion and total darkness, until the work of the first day commenced*.

Now when we refer to geology, (as indeed has already been rendered sufficiently manifest,) the sure monuments which we derive from the study of organic remains, disclose to us evidences of a series of gradual changes and repeated creative processes, going on without any one sudden universal intervention or creation of the existing world out of the ruins of a former. Geology shows that in none of its epochs, least of all in the later, has any universal elemental change occurred, or any trace been left of even a temporary chaos, followed by a simultaneous universal restitution of things.

Comparing then these indisputable conclusions with the representations in the Hebrew Scriptures, to whatever extent critical skill may stretch the meaning, there is an *insuperable discrepancy* in the most material points of the description. We, in truth, gain nothing whatever by critical refinements so long as the passage be admitted to describe a sudden universal interposition of Divine power for the formation out of previous confusion of a world peopled with organized life in its existing forms, at a period corresponding to the origin of the human race according to the received chronology.

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* See Note Q.

The contradiction is scarcely less palpable in these more refined and far-fetched versions than in the vulgar sense.

Surely then, instead of attempting to tamper with all rules of common sense in the interpretation, it would be far better at once honestly to allow that we cannot reconcile the description to the facts, nor find the original of the picture in nature. Surely, looking as well at the plain and obvious sense in which any unprejudiced reader would of necessity view the Scriptural representations, as at the forced and unsatisfactory nature of the interpretations, as also at the manifest unreasonableness of the very principle on which any such interpretation can be rendered desirable,—on every consideration, we shall see the better and wiser course of openly acknowledging the contradiction, and allowing the impossibility of making out an accordance between the literal six days' work of creation, and the visible evidences and existing monuments of it,—between the letter of the representation (either as given in the delivery of the Decalogue to the Israelites, or as subsequently expounded by Moses in the book of Genesis,) and the perceptible and observable order of the works of the same Divine Being from whom the Judaical dispensation emanated.

I have been particular in stating plainly and unreservedly the exact nature and extent of the contradiction between the language of the Word of God delivered to the Hebrews and that of the monuments which we now extract from his works. It seems to me peculiarly needful so to set it forth, and not to shrink from the open and honest avowal of it;—especially while we recollect that the physical evidence which thus palpably contradicts the letter of the Scriptural representation, is the very same which establishes the truth of the Divine perfections, and proves the fact of creation, however different in its mode of accomplishment from what our preconceived opinions would suggest, and however little we may be able to trace the precise means employed in carrying it on.

### *Adaptations to the Ideas of the Jews.*

Now, so far as regards the first chapter of Genesis, we may remark, that even those divines who adopt the most approved views of the nature of inspiration may and do allow, that an inspired teacher might, in irrelevant points, be left to his own unassisted convictions, and on such matters would be no more enlightened than his contemporaries. Many eminent divines have even admitted that current opinions and prejudices, though erroneous, might yet be adopted and turned into a vehicle of moral and religious instruction to those to whom they were habitual, without derogation to the inspired authority of the teacher.

On such a ground we might certainly be permitted to regard the first chapter of Genesis as embodying what were the commonly received ideas among the Jews, borrowed perhaps from some poetical cosmogony, and which Moses was inspired to adapt and apply to the ends of religious instruction;—to the assertion of the majesty, power, and unity of the Creator, and the prohibition of the worship of false gods; especially of those animals and other material objects which were peculiarly pointed out as being merely the creatures of the true God; and this doubtless in a more particular enumeration, because they were especially the objects of that idolatrous worship into which the Israelites were so prone to relapse. The entire description being thus divested of the attributes of a real history, the concluding portion of it, the account of the solemnization of the seventh day as the Sabbath is of course equally divested of an historical character, and thus cannot be understood as referring to any primæval institution, and can therefore only be regarded as having been designed for the more powerful enforcement of that institution on the Jews. And this indeed would be no more than accords with the opinion of many of the most approved commentators, who on quite independent critical and theological grounds, have regarded the passage (Genesis ii. 3,) conveying that institution as correctly to be understood in a *proleptical* or anticipatory sense.

Perhaps such an accommodation might be made to the ignorance of the Jews in the introduction of the law, in order to avoid the unnecessary difficulty of a collision with invincible prepossessions on subjects irrelevant to the purpose of the law, and which in fact would but have tended to make them reject it. It may also be contended that in general any notion of a Divine communication implies *adaptation* to the ideas, language, habits, dispositions, and opinions of the parties addressed; since words, and existing notions, and prevalent modes of belief, of necessity form the only means and channels of communicating the religious truths intended to be conveyed. Thus, in such a case the introduction of views in themselves at variance with truths since elicited, is compatible with the veracity of the inspired teacher, and the absence of such a knowledge as has since been obtained of facts which did not concern the tenour of his particular commission, is without difficulty reconcileable with his inspired and infallible knowledge of the truths which it was his province to communicate.

Some writers, indeed, have felt no repugnance even to the idea of an adaptation, on the part of an inspired teacher, to the prejudices and errors (known by him to be such,) of his hearers; though others, on the contrary, cannot conceive or allow such an accomodation; regarding it as a compromise of integrity incompatible even with moral honesty, and much more with the indwelling of the spirit of truth. Perhaps, however, some distinction may be allowed between the actual and formal inculcation of such views, and their incidental adoption as a vehicle for other instructions.

### *Representation of the Creation in the Decalogue.*

But the great difficulty in the present case arises from the circumstance of the same main statement occurring in a more brief and pointed form in the delivery of the Decalogue. Here it is manifest the same considerations will no longer avail. For admissions which might be allowed with respect to a human teacher divinely inspired, would not apply in the instance of a direct declaration by the Divine voice and actual inscription by the Divine act.

It is needless to enlarge on the difficulties with which the subject is surrounded. It involves a question of the most serious moment from its extensive application in theology, which is forced upon us by the consideration of the present subject, and has also claimed much attention as bearing widely upon the character of other Divine communications recorded in the Bible. It amounts to this,—whether, and to what extent, we can consistently believe the Deity to have adopted the course of accommodating the representations in which he thought fit to clothe his communications to the existing prejudices and belief, even when erroneous, of the parties addressed?

Without pretending here to discuss the general question, I would merely ask, what is the *least* objectionable course to pursue?

In every rock we trace infallible monuments of the progress of creation; we truly read the records in "tables of stone inscribed with finger of God," When we compare those with documents of a different kind, we are compelled to acknowledge the visible inscriptions and the written representation to be at direct variance, so long as the *historical* character of that representation be insisted on. The only alternative is to admit that it *was not intended for an* HISTORICAL *narrative;* and if the representation cannot have been designed for *literal history*, it only remains to regard it as having been intended for the better enforcement of its objects in the language of *figure* and *poetry:*—and to allow that the manner in which the Deity was pleased to reveal himself to the Jews as accomplishing the work of creation was (like so many other points of their dispensation,) veiled in the guise of apologue and parable; and that only a more striking representation of the greatness and majesty of the Divine power and creative wisdom was intended by embodying the expression of them in the language of *dramatic action.*

### *Importance of the Question.*

But without insisting on these or the like suggestions as entirely satisfactory, I will only further observe in general, that with reference to prevailing opinions, the subject is manifestly of a nature which cannot be safely neglected or passed by; but which all friends to truth are most imperatively called upon to examine fully and candidly in the present times, when it is continually being brought more widely into public notice.

Its importance is, indeed, now beginning to be generally acknowledged. It is in vain that one party may endeavour to gloss over the difficulties, or to dismiss them with some vague general remark; and another go into the minuteness of critical details for finding some hardly-strained verbal construction into which the phraseology of the sacred narrative may be tortured to effect a reconciliation; or a third, seek to mislead the public by false and absurd misrepresentations of the geological evidence. These attempts may, perhaps, for the moment, obtain the assent of the unreflecting reader, and for a time lead blindfold the opinions of the many by the authority of some eminent name, or supply a convenient form of words under the shelter of which the believer may exempt himself from the necessity of inquiry, and repose from the labour of thought, and in which the sceptic may find himself provided with a convenient disguise of approved and orthodox exposition, the flimsiness of which will only disclose itself in proportion to the penetration of those around him.

But the success of such expedients cannot be lasting; and the question must soon come to be discussed in its naked simplicity. If such attempts at explanation as those alluded to have successively amused, for a time, the public mind, yet that one has, in turn, yielded to another, shows that the progressive disclosures of geological discovery have tended more and more to extend the dominion of sound inductive principles. Nevertheless, some of those expositions which have recently obtained most popularity, have not been without their use in exploding the more gross errors of those which preceded them, and in some measure preparing the way for the truth. Thus men's minds were formerly startled at the bare notion of long-continued periods and successive dynasties of organized life before the creation of man. The theory of the "days" interpreted as periods of "indefinite" length, had, at least, the recommendation that it got over one main part of the novelty and difficulty, and some notion of the immense duration of the globe became, in a certain degree, familiarized to men's minds as associated with the scripture use of the terms "day" and "year."

They were consequently now less incapable of listening to the disclosures of geological research, and less shocked at the boldness with which induction cleared its own way, to the utter disregard of extraneous authority, and followed up its own conclusions, without respect to received opinions, precisely as the clear evidence of facts illumined the path to truth.

It may also be remarked with satisfaction that in some of the latest and now most widely-circulated of these expositions, there has appeared a far more distinct reference to the genuine authority of inductive principles, an acknowledgment of its rightful claims within its own province. We may also perceive a disposition to less minute attempts at precise interpretation, and an adoption of more vague and indefinite language in statements bearing at all upon the discrepancies. It would appear that the geologist endeavoured to commit himself no further than was absolutely necessary, while he silently passed by those topics on which a definite statement would be unavoidably offensive, and when he clearly saw that all attempts at explaining it away would be impracticable.

And though views not unlike those before referred to and commented upon have been at least in some degree adopted by several eminent geologists, yet all the more judicious have carefully avoided direct and pointed affirmation of what they well know to be so much at variance with geological evidence as the occurrence of an universal chaos, followed by a simultaneous creation, at any recent period. And if the ambiguous language they are sometimes led to use may be open to misinterpretation by superficial or ill-informed readers, yet those eminent geologists seem to me to have acted most wisely who have left the difficulties to the good sense of their readers, aware that the candid and discerning will not misinterpret them, while there is but too numerous a class who will never be satisfied by any elucidation they can offer*.

### *Relation of the Question to Christianity.*

But chiefly I would observe, while there is doubtless much to be considered in the intrinsic nature of the contradiction, yet that which invests them with all their strength as objections is the very common adoption of certain peculiar opinions and views of religion, which nevertheless appear to me far from essential to Christianity.

I would maintain that the question, when regarded in its real character, would assume a far simpler aspect than it too commonly does, and would occasion no serious embarrassment in the minds of any thinking disciples of the gospel, whose views are not mixed up with the very common prepossessions as to the meaning and application of the Old Testament. Hence it is that men are startled at the announcement of the discrepancies we have been considering; and from the prevalence of those opinions alone it is that the question assumes so peculiar an importance, and the difficulties so formidable an appearance.

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* See Note R.

Now whether or not we can vindicate the principle of adaptation (before referred to,) to the peculiar ideas and conditions of the parties addressed, it is at least clear that the representations in question *were*, in point of fact, as specially adapted to the apprehensions of the Israelites, as they are utterly unsuited to us at the present day.

But distinctions of this kind are by no means generally understood among professing Christians. And the extensive prevalence of peculiar notions with regard to the meaning and application of the Old Testament, and especially of the Decalogue, is such as to excite a strong feeling of offence at whatever tends to throw discredit on their literal authority.

To those whose views are such as to amalgamate together all the different parts of the Bible into one, and who do not recognize the distinctions between the different portions of the Divine revelations, a difficulty found in one part will assume the character of an objection to all other parts, and seriously endanger the stability of the whole. And to those who have been led habitually to combine together the religion of the Old Testament with that of the New, whatever is found to preclude the literal acceptation of passages in the Books of Moses, and in the law given to the Jews, will naturally assume the tone of a disparagement to their whole religion.

The contradictions directly affecting the passages containing the account of the seven days, whether in Genesis or Exodus, doubtless oppose fatal objections to the opinions of those who imagine the institution of the Sabbath to apply to Christians. To those who recognise in Genesis the supposed primæval institution of that observance, the rejection of the *historical* character of the passage of course destroys the main argument on which their opinion is built. And to those who adopt the obligations of the Judaical Decalogue, the difficulties must appear especially formidable, and little less than subversive of religion*.

On the other hand, patient attention to the manifest distinctions between the several different divine dispensations, whether to the Jews or the patriarchs, recorded in the collected volume of the Scriptures, will exhibit, in the characteristics of Christianity, a total independence of those passages (whether in Exodus or Genesis,) which are involved in physical contradictions.

Let the candid inquirer then search the records of the New Testament for the simple doctrines of Jesus Christ and his apostles. And perceiving the distinct and independent nature of that doctrine, and assured of the immovable firmness of that rock of moral evidence on which its truth is built, he will be able to afford unhesitatingly to confess and avow, to its full extent, the existence of palpable contradictions between the language adopted in the Old Testament, and in the delivery of the Jewish law, and the existing evidences of the order of creation, without any impeachment of the religion he professes.

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* See Note S.

Systematic theologians, indeed, of several schools not acknowledging the spiritual simplicity of Christianity, have too commonly distorted and disfigured its heavenly features by an incongruous admixture partly of human conceits, partly of the peculiarities of the Judaical, or even, perhaps, earlier dispensations.

But a more simple and direct inquiry into the religion of the New Testament seems to me to lead with increasing clearness to the conviction that such views are but perversions of its real spirit. And from such perversion alone it is that Christianity can ever be exposed to danger, or its credit in the least affected by the circumstance that language at variance with what is now known for physical truth, was employed in the delivery of their law to the Jews, or in recounting to them the records of an earlier age, in passages on which nothing in the new and spiritual religion of the gospel is anywhere made to depend by its Divine founder or his apostles.

When, therefore, we consider these contradictions, they appear but to add clearness to an enlightened view of Christianity; and we may ask with increased confidence, what have we to do with these things? In what way does the question concern the Christian faith? If God thought fit to manifest himself thus to the Jews, what is that to us? To Christians we know he has manifested himself in his Son, teaching an universal moral law, a worship in spirit and in truth.

### *Conclusion.*

IN this section we have considered the contradictions which exist between the dramatic representations and poetical imagery of the Bible, and the phenomena disclosed to geological research at far greater length than the real simplicity of the case would call for, if men were disposed to view it in its real simplicity. But when such a mass of prepossession opposes the admission of rational views of the matter, we are necessitated to enter more at large on the principles involved, in order to clear away the erroneous notions which have encumbered the whole subject.

We have been led into this discussion in direct relation to the main argument, which refers to the proper order and chain of evidence connecting the proofs of natural and revealed truth. We have traced the dependence of natural theology upon the conclusions of inductive science; and contended for the necessity of natural theology as the foundation of the evidences of revelation. Hence we have maintained the essential independence of physical and revealed truth; and have also observed how science, at the very threshold, forces upon us a remarkable warning against mistaking the purport of revelation; thus inspiring those who are able to profit by it with due caution and enlightened discrimination in the use and application of its varied contents. The question respecting a particular discrepancy, at first sight perhaps, seeming of no great importance, is found to involve a very important consideration of *principles;* and to afford a sort of *test* for the due discernment of the distinct design and purport of the several portions of which the Scripture records are composed *.

* See Note T.

# GENERAL CONCLUSION.

THROUGHOUT the whole of the foregoing discussion, in illustrating the mutual relation and reaction between physical science, natural theology, and revealed religion, we have referred much to the various misapprehensions which prevail respecting such connexion among the several branches of the inquiry. We have referred especially to the fears entertained for the safety of religion, and the expedients resorted to for obviating the supposed danger; —expedients as futile as the alarms are groundless. We have commented on the hostility felt against science, and the dread of free inquiry; the disparagement of natural theology, and of physical inquiry as its basis, which are dictated by the adherence to the narrowest and most unworthy views of the tenour of revelation. While the rejection of the physical evidences of creation on the one hand, and the attempts to accommodate the Hebrew Scriptures to them on the other, display an unhappy perplexity of ideas, whether as to the principles of interpretation, or to the character and objects of the different parts of the sacred writings.

We have adverted to the *causes* which have led to the adoption of these views: if we look to the *conse-*

*quences* of encouraging such a spirit, it is evident that its inevitable results will be anything but serviceable to the true interests of Christianity. The followers of these systems may persuade themselves they are powerfully upholding religion, whilst, in reality, they are only thus exposing themselves and their cause to increased suspicion among its avowed enemies, and with many who are desirous to be its friends.

Such narrow views and flimsy speculations insisted on as necessary to the support of the Christian religion, can only tend to throw discredit on its evidences, or be regarded as betraying a secret misgiving as to their soundness, in the minds of its professed disciples.

If such a spirit increase and gain ground among the friends of religion, and continue to be inculcated and urged by its advocates, it is manifest that in the temper of the present times, whether by one course or another, it must equally lead to the very object they are so anxious to strive against, *the wider and deeper extension of irreligion.*

Attempts to oppose rational inquiry and free discussion have always been as vain and futile in themselves, as pernicious to real Christianity. Whenever they have partially succeeded, it has only been, on the one hand, in producing general hypocrisy, ill concealing irreligious licentiousness; or, on the other, in setting faith and philosophy in open hostility: and thus science, from being in its proper way, the powerful auxiliary, has been converted into the enemy, of religion, only by the ill-judged zeal of its friends. By a perversion of Christianity they alienate from it those who would be its best and most enlightened supporters, and professedly setting themselves in array against knowledge, they appear to make open confession that religion must be established on the basis of ignorance; and, as far as they can, force it into an unnatural alliance with darkness rather than light.

Such inquiries as those we have here been endeavouring to elucidate, point to a widely extended connexion and dependence, subsisting between the truths of natural and revealed theology; between the manifestations of the Divinity in the natural and moral creation, in the order and design of the physical world, and in those spiritual revelations of the most elevated kind which we find in Scripture; between the two books in which, (as Bacon* has observed,) Divine communications are alike vouchsafed to us, the volume of nature and the page of inspiration. The points of analogy between the two departments of inquiry are, indeed, peculiarly striking, and most worthy to be more diligently studied and practically applied than they seem to have been. The discussion of them would form the appropriate sequel to the foregoing essay; and such a sequel I have immediately in contemplation.

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* *De Augmentis*, i.

For the present I will close with a very brief recapitulation.

It has been our object to show that the order and dependence of fixed laws, and general principles, constitutes our notion of physical cause and effect. And it is from the arrangement and symmetry of these principles, or causes, that we ascend to the great source of order and harmony: from the facts of *physical* causation to the Infinite *moral* cause, ordaining and animating the entire system of them.

Physical science is the necessary foundation of natural theology: certain of the truths it discloses are warnings against mistaking the purport of Scripture; and the right use of the caution thus inculcated, applies widely in the interpretation of revelation. Inductive philosophy is subservient both to natural and revealed religion. The investigation of God's works is an essential introduction to the right reception of his word.

The conclusions of natural theology are limited in extent, but demonstrative in proof: they are most important in themselves; and indispensable in the foundations of any evidence of revelation. Its truths elevate science into faith, while its deficiencies evince the necessity for further illumination: it tends to inculcate humility and to excite inquiry: and where it shows the path of reason to be closed, it points to the brighter opening of inspiration.

# NOTES AND ILLUSTRATIONS.

# NOTES AND ILLUSTRATIONS.

## Note A. p. 18.

To the *logical* reader, the object of the whole discussion in this section may be explained in a word; induction (in its *physical* sense) is the process of collecting the *evidence* for the truth of the *premises* of the syllogism into which logic analyzes the reasoning. Our present question refers more especially to that which is at once the most difficult and important part, the evidence for the *major*.—See Archbishop Whately's *Logic*, pp. 207 and 228.

The mistake of some writers in supposing that in the enthymematic form, the suppressed premiss is the *minor*, seems to me not improbably traced to the view they appear to adopt, that the *perfect* case of induction would be that in which *every* individual was examined; the less accurate when only a few. Yet as we have observed above, the last are the only cases in which *any reasoning* takes place.

Logic being nothing else than *the theory of conclusiveness*, includes in its analysis the reasoning which takes place in induction as well as in all other cases. It is from a total misconception, therefore, that the dialectic and inductive are often represented as two rival methods on the one hand, or expected to be auxiliaries on the other.

It may, perhaps, be necessary here to remark that the word "analogy," which so frequently occurs in this discussion, is invariably used by me in the simple sense of a *parallelism* or *correspondence* between two sets of things or events, which may have *no similarity* or *resemblance* whatever; analogy is a similarity of *relation* merely, not of qualities. Those readers to whom the distinction may not be familiar, are referred for a full and luminous exposition of the whole case to the notes on BISHOP COPLESTON'S *Inquiry into the Doctrines of Necessity*, &c., p. 122; or to ARCHBISHOP WHATELY'S *Logic*, p. 168.

The reader will find an excellent brief summary of the nature of induction in the Introduction to DR. HAMPDEN'S *Bampton Lectures*, 1837, p. 29.

The view here taken of induction and physical analogy is admirably illustrated in the following masterly passage of Laplace:—

" L'induction, l'analogie, des hypotheses fondées sur les fait et rectifiées sans cesse par de nouvelles observations, un tact heureux donné par la nature et fortifié par des comparaisons nombreuses de ses indications avec l'experience; tels sont les principaux moyens de parvenir à la vérité.

" Si l'on considère avec attention, la serie des objets de même nature; on aperçoit entre eux et dans leurs changemens, des rapports et des lois qui se manifestent de plus en plus, à mesure que la série se prolonge, et qui, en s'étendant et se généralisant sans cesse, conduisent enfin au principe dont ils dependent. Mais souvent ces lois et ces rapports sont enveloppés de tant de circonstances étrangères, qu'il faut une grand sagacité pour les démêler, et pour remonter à ce principe; c'est en cela que consiste le veritable génie des sciences. L'analyse et la philosophie naturelle doivent leurs plus importantes découvertes, à ce moyen fécond que l'on nomme induction. Newton lui a été redevable de son théoréme du binome, et du principe de la gravitation universelle. Il est difficile d'apprécier la probabilité de ses résultats. Elle se fonde sur ce que les rapports et les lois les plus simples, sont les plus communs; c'est se qui se vérifie dans les formules de l'analyse, et ce que l'on retrouve dans les phénomenes naturels, dans la cristallisation, et dans les combinaisons chimiques. Cette simplicité de lois, et de rapports ne paraîtra point étonnante, si l'on considère que tous les effets de la nature, ne sont que les résultats mathématiques d'un petit nombre de lois immuables."

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" L'analogie est fondée sur la probabilité que les choses semblables ont des causes du même genre, et produisent les mêmes effets. Plus la similitude est parfaite, plus grande est cette probabilité."—LAPLACE, *Essai Philosophique sur les Probabilités*, pp. 168—172.

With regard to the importance of analogical considerations, as the guides of inductive research (above spoken of), we shall, perhaps, be reminded (as has been often said,) that the most important philosophical discoveries have been made by chance. It was, however, the observation of D'Alembert, " Ces hazards ne sont que pour ceux qui jouent bien." And it seems to me a still more just view of the matter that the chances happen to all alike, though a few only know how to make use of them: viz., those who are thoroughly possessed with just views of natural analogies.

## NOTE B. p. 62.

To expose the various and most preposterous perversions of geological evidence which have acquired popularity, would be an endless task. I will merely observe with respect to the authors of such misrepresentations, that, in common fairness, there is one requisition, the propriety of which requires to be peculiarly impressed on them, namely, to acquaint themselves, in some moderate degree, with the general nature of the subject, before they adduce detached points of objection as fatal to the whole train of conclusions.

To take, however, an instance of the kind of objection alluded to: one geologist dwells on the uncertainty attending a positive distinction of particular formations from their mineral characters alone, and insists on the attainment of certainty only from their characteristic fossil remains. Another remarks that, in some particular cases, considerable ambiguity attaches to the determination of fossil remains, and that those really belonging to different formations may, in some instances, be confounded together. Hence the objector contends that the argument "halts on both its legs," and triumphs in his inference that there can be no certainty at all in the science! In other words, because either source of evidence *alone* may be defective, therefore both together cannot be satisfactory. Or again, because, in some instances, there may be confessed ambiguities in the interpretation, therefore in no case can there be any certainty. A passage is sometimes cited from Cuvier's account of his researches on fossil bones, in which he, with all the caution of a true philosopher, carefully insists on all the sources of fallacy by which his inquiries were liable to be affected; and speaks, with becoming modesty, of his conclusions, as often being far removed from the evidence of demonstration. And this is then construed by the sceptic into a confession that the whole science has no solid foundation, and is little more than a system of gratuitous hypotheses!

It would be useless to dwell further on such speculations. I should not, perhaps, have noticed them at all, had they not recently received a certain stamp of respectability from their association with the name of a writer of old repute, who has thought it necessary, at the present day, to reappear in a field so different from that of moral and religious discussion, in which his former distinction might have given weight to his opinions: I allude to a pamphlet entitled, *Considerations on Modern Theories of Geology*, &c., by T. Gisborne, M.A., Prebendary of Durham. London, 1837. This is surely not an age in which dignitaries of the Church should be found arraying themselves in hostility to science.

## Note C. p. 87.

Lord Brougham in his *Discourse on Natural Theology*, in a note on Cause and Effect, after stating the nature, and upholding the soundness (as far as it goes,) of Hume's doctrine of causation, yet contends that something more is necessary to a complete view of the subject. Besides the notion of invariable sequence, he maintains we have also a "belief that the one event occasions the other; that there is between the two a connexion beyond the mere relation of junction and sequence, and that the preceding event exerts an influence, a force, a power, over the other, and produces the other."—p. 228.

And the grounds of this belief, he contends, are to be found in the proofs, 1st, of the invariable sequence; 2nd, of the condition that "not only must the second event always have been found to follow the first, but the second must never have been observed without the first preceding it, or at least without some other preceding it, in which case the causation is predicated alike of both these preceding events."—p. 229.

Or, in fewer words, we must prove "that one event always follows the other, and that it ceases when the other ceases." But besides this, 3d, "Our minds form, whether we will or no, another idea, not merely that of constant connexion or succession, but of the one exerting a power over the other by an inherent force; and this is the idea of causation. Whence do we derive it? I apprehend only from our consciousness. We feel that we have a will and a power," &c.

He then traces the effects originating in our volition which we can produce on material objects around us, and contends that we hence form our notion of causation as above defined. That we do thus obtain *an* idea of causation is, I conceive, perfectly unquestionable; but it refers solely to *one species:* viz., that which by our voluntary agency produces effects on matter subject to us; or what I have termed *moral* causation. The author does not pursue this point any further, so as to show *how* or *whether* at all the notion applies to *physical* causes and effects. This is what I have attempted to do above. We transfer the idea by a *fair* analogy to other cases of animal power, and to instances in which we trace the marks of intelligence; but only by a *vague*, *imaginary*, and delusive one, to the succession of *physical* events, or their dependence one on another.

The author proceeds to discuss the idea of *necessary* connexion which (*in the sense* of *à priori* necessity,) is certainly excluded by this view of causes; since "the whole is a question of *fact*, of *contingent* truth." But he maintains that "our ideas of power and of causation are solid and well-founded, although they only refer to a power or a causation which may or may not exist." In this I entirely concur, especially when viewed in connexion with the distinctions here laid down.

## NOTE D. p. 120.

THE achromatism of the eye is a subject which has occasioned much discussion, and that of a remarkable kind. The most eminent optical writers have been directly opposed in opinion as to the *fact*. And those who have admitted the *fact*, have yet held it *unaccountable*, and have sought *indirect* explanations of it as being, strictly speaking, *impossible* in theory.

I have (as I believe for the first time,) shown that it is perfectly *possible in theory*, whilst it may or may not be the *fact* in different *individual cases*. I mention this the more as the drift of my investigations have been strangely misconceived by some. They are given in one of the series of tracts printed by the Oxford Ashmolean Society: *On the Achromatism of the Eye*. Oxford, 1834. See also *London and Edinburgh Journal of Science*, April 1835.

## NOTE E. p. 121.

THE extreme confusion which has been introduced into discussions of this nature, owing to the ambiguity of the term " cause," has been ably exposed by several writers. The same point has been dwelt upon by Mr. Irons, [*On Final Causes*, p. 53,] who has examined largely the various opinions of ancient and modern writers on the subject, and has discussed the views of Hume and others with regard to the nature of causation. With so extensive a knowledge of philosophical authors, (to judge from his quotations,) it seems strange that he has omitted all reference to the *physical* part of the subject, and has not been led to the distinction on which I have so particularly dwelt between the physical and the moral senses of the term "cause." He has, in fact, confined himself throughout to the idea of an operative agency, or what I have called "moral causation;" and considers all idea of causation as including that of an efficient influence; defining a cause to be "that which of itself makes any thing begin to be," (pp. 74, 79, &c.,) and which is, in fact, intelligence.

Proceeding, then, on such an idea of causes, and omitting all reference to the great argument from physical causes, in the sense in which I have explained them, it is not surprising that this author should disparage to the uttermost the argument from final causes, of which he takes so unhappily contracted a view. He has, however, clearly distinguished the boundary between our knowledge of the bare fact of fitness or adjustment in created beings and their properties, and the inference of design and intelligence. The former, he shows, was the strict sense in which alone the ancient philosophers spoke of "final causes." Among other points, he particularly refers (p. 125,) to a circumstance related by Mr. Campbell, the missionary; that on showing a watch to some savages, they were by no means able to infer design; this example has, in fact, been much dwelt upon, and regarded as decisive against the efficiency of Paley's argument. But I would ask were the savages able to reason in any other case? or to make inferences at all? This must obviously be shown before the case can be of the slightest avail to the argument. Paley, I apprehend, never contemplated the reasoning as addressed to savages.

## Note F. p. 178.

The following passage supplies a good example of the extraordinary ideas which, in some instances, prevail with respect to the bearing of the study of physical, on final, causes.

"But, it is rejoined, you explain every thing by your omnipotent gravitation,—what is the origin of that? I answer, this too we know full well. The daughter of the old blind Fate,—her servants, magnitude, number, and proportion,—her inheritance, a universe without a God, which requires no God. . . . When the great astronomer Lalande denied a Deity, could trace in the heavens no God, in the movement of the stars no finger of God, we are compelled to allow the logical consequence of his reasoning. That high order and adaptation of end and means is only the product of the rigid mechanism of necessary physical laws; there, above, is only a blind mindless destiny, the absolute ruler of its universe. But I appeal to the truth of the saying in St. John,—In the spirit only shall we worship God; and in what only our science is for mind, is its dignity and value to be found. He only can style the order of the universe an adaptation of means to end, who brings to its observation a belief in the reality of design. But the true interpretation of the order of design lies far more clearly apparent in the mind of man. The infinite Spirit does not bail itself under proportion and number! The play with number is an easy play, its joy *only* the joy of the imprisoned spirit at the clank of its fetters."—Professor Fries' *Lectures on Astronomy*, quoted in the *Edinburgh Review*, cxxvi., p. 450.

The quotation is given in the course of an article, one object of which is to prove that the highest mathematical or physical talent does not confer, nay, even impairs, the power of reasoning on other subjects; of this the passage quoted certainly supplies a remarkably strong instance, (though not, I believe, contemplated in that light by the reviewer,) if the author be really entitled to the mathematical reputation which he is said to bear in Germany.

This mass of confusion of ideas would be at once cleared away by a slight attention to those distinctions which I have endeavoured to indicate.

It appears to me that the attempt to define the term "blind fate," or "necessity," would at once decide all questions of this sort. I can attach no meaning to it which is not at once contradictory to the notion of design. Blind fate could not produce adaptation to an end; if it could it would no longer be blind fate but eternal providence.

We may take for another example the remark of an extremely well-intentioned writer:—

"It is manifest that the mineral geology, considered as a science, can do as well without God (though on a question concerning the origin of the earth,) as Lucretius did."—PENN, *Comparative Estimate, &c.*

If geology proceeded by any other course than that of the *independent* study of "minerals," it would neither be "a science," nor could it afford the slightest *proof* of a Deity. It investigates "a question concerning the origin of the earth," without making any *assumption* of a Creator; and that investigation leads to the most decisive *proof of a Creator*, which would be no proof but an argument in a circle, if it had *assumed* a Creator in the first instance. It is sufficient to add with regard to Lucretius, that to him those proofs were wholly unknown.

I will cite one more passage in further illustration:—

"It has ever been the refuge of scepticism to believe that the laws of nature being fixed permanent and invariable, this frame of things is eternal; that the earth and all the apparatus of bodies in this and other systems were ever in the state they now are, and will ever continue the same. In this their scheme they think no God needful."—DR. WOODWARD, *Nat. Hist. of Earth*, p. 9.

I should merely state the matter thus:—The existing permanence and uniformity of nature *is no proof* that the world had not a beginning. The existence of order and adjustment *is* the proof of design and Divine Intelligence. The *assumption* of a Deity in natural philosophy would but render the evidence of natural theology a *petitio principii*.

## NOTE G. p. 185.

LORD BROUGHAM in more than one instance charges Paley with a distaste or incapacity for metaphysical speculation; and in particular exemplifies the charge in the absence (as he contends,) of all distinct mention in Paley's argument of the proofs of *mind* as the origin of the design and adaptation found in the material world. "He (Paley,) assumes the very position which alone sceptics dispute. In combatting him they would assert that he begged the whole question; for certainly they do not deny, at least in modern times, the *fact* of adaptation. As to the fundamental doctrine of causation not the least allusion is ever made to it in any of his writings, even in his Moral Philosophy."—(*Disc.*, note, p. 79.)

In reply to this, Dr. Turton (p. 122,) quotes a passage from Paley's chapter on The Personality of the Deity, in which he distinctly contends that the evidences of design prove a personal agent; that they are the evidences of mind, and that mind constitutes personality. He further traces our conviction of this to similar effects produced by moral agents within our observation.

Dr. Turton has in another place ably explained the plainness of style and absence of profound metaphysical speculation which characterize Paley's writings as originating in the manifest design he all along entertained, and so successfully pursued, of putting the whole argument in a perfectly popular form, so as to place it within the grasp of the most limited or least cultivated understanding. This consideration appears to me to afford at once a perfectly satisfactory vindication of Paley, if he had not entered into the details of the question. But I cannot help thinking that in this (as in some other instances,) the Regius Professor has been somewhat too severe on the noble author. The *fact* certainly does appear to me, upon the most careful review of the passages adduced, to be much in favour of the justice of Lord Brougham's complaint of the omission of an *exact, philosophical* discussion of the point in question. That the omission was *designed*, and *wisely* designed, in reference to Paley's particular object, does not affect the question of its being an omission, when considered in a strictly metaphysical light. The precise point of the inference of *mind* is rather asserted than proved, rather *illustrated* than rigidly *analyzed.* It is a subject worthy of more profound investigation than I have happened to find bestowed upon it. So far as the doctrine of *causation* is concerned I may venture to hope that the illustrations conveyed in these pages may not be useless towards supplying the deficiency. At any rate it is one of the most valuable points of Lord Brougham's Discourse, that it urges attention to this particular question with so much force and originality.

Lord Brougham, in his note on cause and effect, in the course of some remarks on necessary connexion, refers to the doctrine of a first cause; contending that the idea of causation which we derive from our volition (before referred to,) is *essential* to that doctrine. Had we not such an idea, that of "power or causality could never have been obtained by us from any observation of the sequences of events. The idea of design or contrivance in like manner must have been wanting to us; and hence I cannot understand how, but for the consciousness of power, we could ever have been led to the belief in the existence of a first cause."—(P. 231.)

If we take the term causation in the sense to which I have above referred, of *moral* causation, the justness of these remarks will be fully admitted; that distinction has not been introduced by the author.

On the "psychological argument," as well as on several other important questions connected with this subject, some acute observations will be found in a small tract, entitled, *Remarks on Lord Brougham, &c.*, by T. Martin. London, 1835.

## NOTE H. p. 191.

THE anecdote of Boyle referred to in the text has been often repeated. I have not, however, been able to discover the precise authority for it; but the sentiment will be found expressed in his *Considerations on the Usefulness of Experimental Philosophy*, p. 18, ed. 1664.

A similar opinion is advocated by Bacon, (*De Aug.*, lib. i.,) applying the passage in the Proverbs, "The spirit of man is the candle of the Lord." (xx. 27.)

## Note K. p. 196.

This prejudice against what is called the pride of science, as an impious intrusion on forbidden ground, is precisely that expressed by Pliny, when speaking of Hipparchus forming his catalogue of the stars; he says,—"Ausus rem etiam Deo improbam annumerare posteris stellas." I have commented upon the influence of such prejudices in my *History of Science*, in the *Cabinet Cyclopædia*, p. 83. The reader is also referred for some admirable observations on the "Pride of Reason," (powerfully illustrated by comparison with the "Pride of Eye-sight,") to the Rev. J. Blanco White's *Observations on Heresy and Orthodoxy*, p. 84.

The celebrated controversy between Newton and Leibnitz was disgraced by the attempt of the latter to fix upon the doctrines of his great rival the charge of a tendency to materialism and atheism. The malicious character of such an attempt was equalled only by the absurdity which must manifestly attach to it in the eyes of any one who had read Newton's writings. Groundless as such a charge was, yet it tended much to keep up the prejudices which for a long while prevailed against the reception of the Newtonian theory; and received support from the readiness with which the generality of men cling to the authority of a distinguished name, especially if it sanction them in rejecting any new doctrines, which are always distasteful to the mass of mankind simply because they are *new* and require thought, and perhaps the surrender of established ideas. To such sources we may perhaps trace the prevalence of still-lingering prejudices against physical philosophy in general as having a tendency to cherish intellectual vanity, and a spirit hostile to the inculcation of religious truth.

## Note L. p. 199.

Views similar to those here stated have the sanction of some of the highest philosophical authorities. Thus Aristotle in his treatise, *De Mundi*, cap. vi., represents it as unworthy of the Supreme Being, "*αυτουργειν παντα*;" supporting it by a comparison with the condition of a monarch and his subordinate functionaries, &c. The same idea is upheld also by Lord Bacon, *De Augmentis*, book iii. c. 4.

Boyle observes, "As it more recommends the skill of an engineer to contrive an elaborate engine, so as that there need nothing to reach his ends in it, but the contrivance of parts void of understanding, than if it were necessary that ever and anon a discreet servant should be employed to concur notably to the operations of this or that part, or to hinder the engine from being out of order; so it more sets off the wisdom of God in the fabric of the universe, that he can make so vast a machine perform all those many things which he designed it should, by the mere contrivance of brute matter, managed by certain laws of motion and upheld by his ordinary and general concourse, than if he employed from time to time an intelligent overseer to regulate and control the motion of the parts."—*Inquiry into the Vulgar Notion of Nature.*

Lord Kames, in his "Essay on the Laws of Motion, &c.," *Edinb. Phys. and Lit. Essays*, vol. i., after quoting the above passage of Boyle, remarks: "What may be the opinion of others I cannot say, but to me this argument is perfectly conclusive. Considering this universe as a great machine, the workmanship of an intelligent cause, I cannot avoid thinking it the more complete the less mending or interposition it requires. The perfection of every piece of workmanship, human and divine, consists in its answering the designed purpose without bestowing further labour upon it."

That an opposite feeling should prevail in a *poet* is not surprising, and we trace it in the *Dunciad*, canto iv. l. 474. But it is singular that views so rational and satisfactory should have been objected to by a *philosopher* like Dugald Stewart, who condemns them in no measured terms as "absurd;" and this upon the idea that it would be unworthy of the Deity to employ a machinery of second causes, *because* machinery among men is avowedly introduced to save labour and accomplish the purpose in view more easily and completely, which of course cannot apply to the designs of Omnipotence.—*Philosophy of Mind*, ii. 555. But the real question obviously refers to the machinery, not for the *work* it does, but for the *skill* displayed in its *construction* and *operation;* the proofs of which are unquestionably stronger, as it requires less manual interference.

The following passage from one of the most eminent of Newton's followers is worthy of careful consideration:—"As we cannot but conceive the universe as depending on the first cause and chief mover, whom it would be absurd, not to say impious, to exclude from acting in it; so we have some hints of the manner in which he operates in nature, from the laws which we find established in it. Though he is the source of all efficacy, yet we find that place is left for *second causes* to act in subordination to him; and mechanism has its share in carrying on the first scheme of nature. The establishing the equality of action and reaction, even in those powers which seem to surpass mechanism, and to be more immediately derived from him, seems to be an indication that those powers, while they derive their efficacy from him, are however in a certain degree circumscribed and regulated in their operations by mechanical principles; and that they are not to be considered *as mere immediate volitions of his*, (as they are often represented,) but rather as instruments made by him to perform the purposes for which he intended them. If, for example, the most noble phenomena in nature be produced by a rare elastic *æthereal medium*, as Sir I. Newton conjectured, the whole efficacy of this medium must be resolved into his power and will who is the Supreme Cause. This however does not hinder but that the same medium may be subject to the like laws as other elastic fluids in its actions and vibrations; and that if its nature were better known to us we might make curious and useful discoveries concerning its effects from these laws. It is easy to see that this conjecture no way derogates from the government and influences of the Deity, while it leaves us at liberty to pursue our inquiries concerning the nature and operations of such a medium; whereas they who hastily resolve these powers into immediate volitions of the Supreme Cause, without admitting any intermediate instruments, put an end to our inquiries at once, and deprive us of what is probably the most sublime part of philosophy, by representing it as imaginary and fictitious."—MACLAURIN, *Account of Newton's Disc., conclusion.*

In this passage we cannot fail to recognise the expressions of a powerful mind,—fettered, indeed, by certain metaphysical notions, yet sufficiently free to gain a clear view of the real bearing and use of physical truth; perhaps designedly cautious in the language and mode of illustration adopted.

## Note M. p. 225.

In support of these and the like views, the writings of poets are frequently appealed to, and with good reason, as such ideas are properly congenial to the region of poetry;—the error lies in mistaking them for philosophy. Thus a well-known and justly admired passage of Cowper, (*Task*, book v. l. 710,) is often cited in confirmation of the opinion above adverted to. If thus applied, it involves the fallacy in reasoning here exposed. The writings of that amiable poet in general, are a favourite authority with a considerable party for their disparagement both of natural theology and of physical science; a subject on which it must be manifest, the expressions of a poet, and especially one of Cowper's tone of mind and general acquirements, cannot be regarded as of any weight.

In the productions of another school, whose views border closely on the poetical, and would be unexceptionable if honestly proposed as such, we find similar sentiments upheld. One specimen is referred to in p. 227. In the same publication we are warned that "they who interpret not what men call nature by the Bible, will bring down the Bible to the standard of nature;" and that "they who resolve every thing into secondary or physical causes, and will not see Him who is the cause of all causes, and worketh by all those things whose operation meets our senses, will lose all sense for discerning His hand when Scripture plainly declares it."—*Dr. Pusey's Sermon*, p. 2. If they did not resolve everything into secondary causes, they could not arrive at any evidence of the first; nor again find the proofs of the truth of Scripture.

I have referred to the principle on which this school grounds its pretensions, and the sentence of the church, to which it makes its appeal, yet does not invest it with a Divine authority; while, with strange inconsistency or short-sightedness, it still professes to ascribe a *Divine* character to Scripture. In another publication,* I have exposed these inconsistencies, and shown that the whole system is a mere *petitio principii.* To this school I apprehend, Mr. Irons belongs. Hence we may trace the motive which urges him so zealously to cry down natural theology, the use of physical science, and human reason.

## NOTE N. p. 230.

I WILL cite one instance illustrative of the confusion of scientific and religious grounds of belief above referred to:—

Professor Gaede, of Liege, observes, that "in order rightly to understand the voice of God in nature, we ought to enter her temple with the Bible in our hands." This sentiment is quoted with much approbation, and indeed adopted as the foundation of his argument, by Mr. Kirby, in the Introduction to his *Bridgewater Treatise.* To my apprehension I must confess it is quite unintelligible. The testimony of nature to the Divine existence and perfections *must be first* received *independently* of the Bible, if we would have any rational ground for believing the Bible. To invite us to the study of natural theology with the Bible in our hands, is exactly like recommending the student to enter upon Euclid with Newton's *Principia* in his hand, or to commence the study of the Greek alphabet with Homer as a guide.

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* *Remarks on a Letter to Lord Melbourne relative to Dr. Hampden, &c.* Oxford, 1836.

This strange confusion of ideas pervades the whole of the author's argument in his elaborate Introduction; notwithstanding some few excellent remarks on the right use of Scripture as not designed to teach philosophy, (p. xix. and xlv.) he falls into the most extraordinary inconsistency with his own principles conveyed in those very remarks, in his theories of the deluge, the central abyss, &c. &c.

## NOTE O. p. 235.

THE following incident, involving the opinions of two eminent scholars is given by the learned author of the *Parriana*:—" I had once the pleasure of driving the doctor (Parr,) a few miles into the country to visit a former pupil. When we returned together it was a bright starlight night, and the beauty of the scene over our heads led me to ask him, with reference to the Mosaic record, how long, in his opinion, those orbs had rolled and glittered. He made some remarks on the term (created,) employed by the sacred penman, distinguishing between creation, strictly understood, and formation, or putting the then chaos into its present order. I did not then admire the distinction which throws back the creation to an indefinite period, and thrusts the Creator from what seems his proper place; and if Moses should fail us here, and the same mode of criticism be adopted in other parts of Scripture, I fear we shall have no proof of the creation of a *material* world at least."

I am not quite aware to what *date* this anecdote belongs, it may therefore refer to a period before the evidence of geology was so decisive as it has since become. But under any circumstances the apprehension here entertained of "thrusting the Creator from his proper place," by such conclusions as His visible works afford, and the expression of a dread of losing proofs of the creation from the adoption of certain modes of interpreting Scripture, betray the want of clear views of the evidence whether of natural or revealed religion.

## NOTE P. p. 251.

As by far the clearest, shortest, and most explicit statement of the most recent *Biblico-geological views* referred to, which I have seen, I will mention an article in the *Magazine of Popular Science*, No. 12, January, 1837, bearing the signature of J. P. S., which I believe are the initials of an eminent and learned dissenting divine. I refer particularly to this paper, as conceiving it may possess considerable weight with many persons; while the tone and spirit in which it is written is such as will secure it an impartial perusal from all parties.

The question respecting the description of the creation is brought into the shortest compass by looking at the precise statement which the author gives of his own views; he conceives,—

1st. That "the beginning" means an indefinitely long period during which the successive formations recognised by geology may have taken place.

2dly. "That at a recent epoch our planet was brought into a state of disorganization, detritus, or ruin, (perhaps we have no perfectly appropriate term,) from a former condition."

**3dly. That out of this condition the existing creation took place, literally, as described, in six natural days.**

**The author has also expressed his positive conviction that any real contradiction of the Scripture account by geological phenomena must at once *involve the rejection of the truth of the whole Bible.* But he contends that the above interpretation removes all discrepancy, and thus secures us from the consequences otherwise *fatal* to religion.**

**He does not appear to be aware that the second of the positions above assumed is precisely that which is absolutely contradicted by all geological evidence.**

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Great weight has been attributed to certain critical remarks by Dr. Pusey, Regius Professor of Hebrew, (inserted as a note in Dr. Buckland's *Bridgewater Treatise*, vol. i. p. 24,) on the interpretation of those expressions in the 1st chapter of Genesis, which bear most upon the Biblico-geological views.

While I most readily acknowledge the critical value of remarks coming from so eminent an authority in Hebrew literature, I cannot perceive that anything substantial is gained by them in support of the geological version of the passage; or, in other words, the hypothesis that Moses was inspired to teach geology either to the Israelites or to us.

It appears, in the first place, from Dr. Pusey's statements, that the original word rendered "created," does not necessarily imply the idea of an actual calling into existence out of nothing. This, indeed, does away with the commonly received Scripture proof of that prevalent opinion, but bears very little upon any geological difficulty.

In the next place, the separation of the two first verses, as a distinct account of a primæval formation, is considered by

Dr. Pusey to be justified on critical grounds, and a new history of the existing creation considered to begin with the third verse.

This (as I have already observed,) appears to me still to leave the main contradiction untouched; however, the learned author considers this question of punctuation to be important, and confirms it by an appeal to the opinions of old writers, and to the mode of division adopted in some early translation of the Bible; he adds,—" This then is just the sort of confirmation which one wished for, because, though one would shrink from the impiety of bending the language of God's Book to any other than its obvious meaning, we cannot help fearing lest we might be unconsciously influenced by the floating opinions of our own day, and therefore turn the more anxiously to those who explained Holy Scripture before those theories existed. You must allow me to add, that I would not define further. We know nothing of creation, nothing of ultimate *causes*, nothing of space, except what is bounded by actual existing bodies; nothing of time, but what is limited by the revolution of those bodies. I should be sorry to dogmatize upon that of which it requires very little reflection or reverence to confess that we are necessarily ignorant. 'Hardly do we guess aright of things that are upon earth, and with labour do we find the things that are before us; but the things that are in Heaven who hath searched out ?'"—*Wisd.* ix. 16.

I must observe that, in the expressions here quoted, there is a certain ambiguity which seems to leave them with a meaning somewhat dependent on the reader's own turn of thought. If the "floating opinions" and the "theories" of the day mean those of the Bible-geology school, I most cordially agree with the learned author in his dislike of them; but I cannot see how a coincidence with the views of ancient commentators can possess any weight in relation to a subject which they could not have had in view, since it was one of which they were altogether necessarily ignorant. Nor again am I able distinctly to understand in what manner the latter clause of the paragraph bears upon the question. I entirely agree with the author in his remarks on our ideas of ultimate causes, space, and time; but I know not to what *dogmatizing* he alludes on these points, in any geological speculations. Even the Bible-geologists in their theory of the "days" understood as ages, surely do not dogmatize on any notions of time or space. Still less do rational geologists refer to any metaphysical distinctions of the kind. They merely affirm the succession in order of time, of deposits which are arranged one on another; and of the respective races of animals entombed in them. The quotation adduced at the end seems to me to refer rather to theological than to physical subjects, and to put a check on inquiries directed not to the structure of the earth, but to the mysteries of heaven.

## Note Q. p. 254.

Among the numerous publications on the question of the history of the creation, I have seen one of a nature in some respects so different from most of the other speculations on the subject, as to demand a brief notice here. It is entitled *Remarks on Dr. Buckland's View of the Mosaic Creation*, &c., by Eretzsepher. London, 1837. The author (unlike most of his contemporaries,) is evidently qualified for his undertaking by some knowledge of the subject; or at least refers to the conclusions of distinguished geologists with a fair appreciation of the weight to be attached to them, and without the smallest disposition to cavil at them on religious grounds. He has, in fact, in the first instance, taken the very same general tenour of observation as that of the present discussion; referring, in particular, to the strong and unanswerable argument of the absence of all indications which must have been left of any universal chaos in a comparatively recent period, followed by a simultaneous creation. He has adduced the unquestionable facts of the co-existence of recent with extinct species in the later tertiary formations; and has put in the most pointed manner, the irresistible conclusion that the supposed "last great change, neither preceded nor was coeval with the formation of the newer pliocene; nor could it possibly have succeeded that formation." (p. 15.) He avowedly passes by the question "how any universal ingurgitation of the land could be brought to pass," and hints at the utter impossibilities which are involved in any hypothesis of this kind.

In supporting these plain inferences from facts, he has given the valuable testimony of a professed and strenuous advocate of religion to the necessity of honestly rejecting all those temporizing expedients and unworthy suppressions or disguisings of the truth, which have been so commonly practised.

In attempting to supply the deficiencies, as he thus considers them, of the theory of a recent universal change corresponding to the Mosaic creation, he is not equally happy, nor very consistent with the spirit of his previous remarks. He adopts, in general, the notion of the "days" meaning indefinite periods; but in the particular details seems to me not more felicitous nor satisfactory than any of his predecessors, in the vain and revolting attempt to lower and destroy the majestic imagery of the sublimest composition in the world; and by the introduction of a literalizing interpretation, to torture the whole representation into a sense which it never could have been intended to bear.

## NOTE R. p. 264.

ON the question of geology and Scripture, the reader will find some interesting remarks in an article on the "Recent Progress of Geology," &c., by Dr. T. Thomson, inserted in Dr. R. Thomson's *British Annual for* 1838.

Observations on such a subject, coming from a writer so pre-eminently distinguished in chemistry and the kindred sciences, will be duly valued. And of the general excellence of their scope and tenour, I willingly express my conviction. Did they come from a less eminent authority, I would not stop to notice what strikes me as defective in some parts of the reasoning. But in the present instance, my desire to see such a subject treated solely on the unassailable grounds of truth, must be my excuse for alluding to one or two points which seem to me open to objection.

At the commencement of the concluding portion of his article (p. 259,) the author says:—

"It has been affirmed by some wrong-headed or fanatical individuals, that the facts disclosed by geology are inconsistent with the Mosaic account of the creation; and on that account attempts have been made to discourage the cultivation of geology," &c.

Here I must confess either I do not apprehend the meaning, or else the author must be including himself under his own censure, since the views he has just before been broaching evince most indisputably those very contradictions which he here describes as affirmed by "some wrong-headed or fanatical individuals."

However, he next makes some excellent observations on the objects of revelation as totally distinct from those of science; in which I most fully concur. But in a subsequent paragraph, he affirms "the cosmogony of Moses is nothing more than this, 'In the beginning God created the heavens and the earth,' a proposition which no man of science can refuse to admit," &c.

Now, doubtless if "the cosmogony of Moses" were really "nothing more than this," there would exist no difficulty, no question on the subject. The difficulty arises entirely from the circumstance that "the cosmogony of Moses" *is* something more than this, viz., the literal description of the six days' work. And moreover, that this is not merely "the cosmogony of Moses," but is recorded as the Divine declaration from Mount Sinai.

The remainder of the author's observations consist in acutely turning the fact of successive creations of species into an argument in favour of Christianity; since revelation rests on the admission of special intervention, and these, he argues, are cases of special intervention. On this point I can only refer to the considerations adverted to in the third section. We do not yet know what secondary means may have been employed to bring about those successive creations of species, or modifications of the forms of organized life. The author also employs, for the same purpose, the doctrine of equivocal generation. The recent researches of Ehrenberg* have, at least, thrown great doubt on that doctrine.

## NOTE S. p. 266.

I HAVE before referred to one writer as a specimen of that school who consider the cause of religion as unable to stand investigation; and regard science in general, and geology in particular, as subversive of religion; viz., Mr. Cole, in a tract addressed as a letter to Professor Sedgwick, but in which he devotes two pages to myself and my fearful heterodoxies. Of all the writers of this school with whose works I have happened to meet, this author appears by far the *most* rational and *consistent*. He follows out his principles to their logical extent; insisting rigidly on the very letter of every part of Scripture as applying universally, he contends not only for the *historical* nature of the description of the creation, but for the obligation of the Sabbath, and for absolute predestination. The very title, implying that geology, if true, is *destructive* to the whole truth of revelation, is a startling assertion. And the whole volume is full of such doctrines; that to maintain geology is, in fact, infidelity. That scientific and inspired truth are essentially hostile to each other; and so incompatible, that one or the other must be rejected, &c., concessions which can but give a palpable triumph to scepticism.

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* See his memoir in Poggendorf's *Annal.* XXIV., and translated in Taylor's *Foreign Scientific Memoirs,* Part IV., p. 555.

## NOTE T. p. 269.

In the able article in the *Edinburgh Review*, (No. cxxxi.) on Dr. Buckland's *Bridgewater Treatise*, some remarks are made on the geological discrepancies with Scripture, and the prevailing views respecting them, which appear to me to suggest matter for more consideration than the reviewer seems disposed to bestow on the subject,—*to those who desire to see it treated on the basis of truth.*

The article throughout exhibits the most luminous and philosophical views of the scientific part of the inquiry; the writer, however, seems anxiously to avoid any precise discussion of the theological difficulties; and, in fact, skilfully eludes all such questions by appealing in forcible terms to the existing satisfaction of public opinion in Scotland on these points, as resting on interpretations now universally received; and then, going off into an eloquent view of the general scope and design of revelation as distinct from scientific objects, he there leaves the matter. Yet in the representation thus made, slight and general as it is, there seems to me much of interest and demanding notice in connexion with the object of the present work.

After a luminous historical sketch of the progress of geological views, the controversies which prevailed, the hostility once excited among the Scottish clergy against the new science, and the gradual cessation of that opposition, the present situation of affairs is thus described (p. 14):— "After having for half a century 'stumbled on the dark mountains,' the Church is now feeding her flock on the green pastures of the Huttonian geology. She recognises as an impregnable truth the great principle for which Hutton and Playfair were proscribed, and has commanded the sacred scholar to accommodate his philology to the Huttonian interpretation of the language of Moses." Now, not to dwell upon the somewhat singular kind of spiritual pasture here assigned to the Christian flock, I confess I neither understand how the Church succeeds in enforcing this command on the sacred scholar; nor what sort of "philology," can effect the accommodation required. I have before adverted to the various philological attempts, which are all manifest failures, not only in principle but even in their critical details. I have also pointed out the actual force of the contradictions; and at the same time, as appears to me, the entire independence of Christianity with respect to them. To apply such considerations, it would seem, must involve peculiar difficulty in the case of a church whose formularies (I believe,) are grounded upon a very express adoption of the obligations of the Old Testament dispensation, and especially of the Sabbath, in accordance with the dogmas of the Westminster Assembly. Notwithstanding, by some means, it seems, so completely has this accommodation been brought about, to the satisfaction at least of all inquirers in Scotland, that the reviewer says of Dr. Buckland's chapter on the subject,—"To us in Scotland it seemed a work of supererogation:" the question had been "discussed to exhaustion during the Scottish controversy between the rival theories. Even the pious Professor of Divinity in our university had adopted the explanation given by the Huttonians, and the public mind was equally tranquillized."—p. 15.

The precise nature of the explanation given by the Huttonians, and adopted by the Professor of Divinity, does not appear. However, that the public mind should have been tranquillized on the subject is not surprising. The great mass of nominal believers doubtless looked on the disclosures of geology with consternation and horror as long as they were told that its doctrines were subversive of religion by those who ought to know. The Professor of Divinity had but to adopt the "Huttonian explanation," and the Church to enjoin on its ministers the use of a corresponding "philology," and the public thus enlightened, immediately ceased from their outcries, either against geology, or in support of the truth of religion, and relapsed into their ordinary utter indifference to both.

The reviewer, however, continues in a subsequent passage:—"The question, indeed, lies within a narrow compass. The truths of religion and science can never be at variance. A geological truth must command our assent as powerfully as that of the existence of our own minds, or of the Deity himself; and any revelation which stands opposed to such truths must be false. The geologist has, therefore, nothing to do with revealed religion in his scientific inquiries. It is the office of the divine to interpret the Sacred Canon; and if he does this with the discrimination and learning it demands, he will never find it at variance with the deductions of science. If Scripture, on the contrary, be studied by instalments, and viewed from insulated points, and interpreted literally in its detached passages, we shall find it at variance with itself, and shall reproduce all the heresies which have disgraced the history of the Christian Church. But if we look at the sacred scheme as a whole, and generalize its individual propositions, we shall find in it a unity of doctrine," &c.

In the general excellence of these remarks I fully acquiesce. The observation in the first sentence is undeniable;—truth cannot be contrary to itself; I would merely notice that this seems a singular *reason why* the geologist should "*therefore* have nothing to do with revealed truth" in his researches. That he *has* not is very true; not for *this reason*, but on account of the essential independence of scientific inquiry into the works of God, as I have before explained.

But further, it is worthy of notice with how much skill the precise point of the contradiction is eluded under the eloquent and undeniable generalities by which the responsibility is shifted on to the shoulders of the divine. His business it is to interpret Scripture; which, when rightly understood, will never be found at variance with geology: —*And why? Because* when comprehensively studied it furnishes a unity of doctrine, a spiritual law, &c., all which great objects of revelation the writer proceeds to dilate upon in the powerful language of just encomium through the remainder of the paragraph.

In a general sense nothing can be more just than the remarks here made on the principles of Scripture interpretation; yet this appears to me not a little at variance with the literal philology before recommended.

In a more particular sense, however, I cannot but regard the indiscriminate adoption of this "generalizing" system, by which all the different parts of the Sacred Records are amalgamated into one, and the distinction of their separate applications lost sight of, as the very source of the difficulty and objection felt on the ground of the geological discrepancies.

There is no doubt a plausibility in the vague assertion that geological conclusions cannot really come into collision with religious truths:—but the facts show that in the present instance there *is* such a collision;—since the literal history of the creation involves the primæval institution of the Sabbath; a collision which no philology can prevent, no generalities disguise;—but it can become *an objection only from* the prevalence of that system which mixes up Christianity with older dispensations.

# SUPPLEMENTARY NOTE,

## ON THE GEOLOGICAL EVIDENCE OF FORMER CONDITIONS OF ORGANIZED LIFE, AND ITS UNBROKEN SUCCESSION.

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In corroboration of my remarks on the unbroken series of changes by which the existing order of things on the globe has been introduced, I have peculiar satisfaction in being permitted to present my readers with the following extract from a letter with which I have been favoured by **Professor Phillips**, of King's College, London:—

"The *origin* of organic life upon the globe, it may, perhaps, be impossible for geologists to fix, either with reference to the successive *times* disclosed by the examination of the earth's crust, or the geographical *position;* but it is certain that in descending the series of strata, *i. e.*, in ascending the stream of time, we arrive at epochs continually less and less fertile of animal life, and finally reach a terminus of this life, as judged of by the organic remains in the rocks, *before attaining* the limit of geological time, estimated in terms of the thickness and nature of stratified deposits. This is the true *geological* definition of the origin of organic life on the globe.

"If it should be asked, as is natural, were there any previous systems of life on the globe? I reply, this is a matter to be considered on the evidence collected by geologists as to the physical conditions under which the earlier strata of the globe were deposited in the primæval ocean. Perhaps the balance of evidence, including of course that derived from general physical considerations, is in favour of the hypothesis that the globe was in a state unfavourable to the development of organic life by reason of the greater influence then exercised by its proper heat upon the phenomena at the surface, than after a considerable thickness of non-conducting materials (the earlier strata,) had become effectual in retarding the flow of heat from within. At all events, *for us*, reasoning from facts observed, the origin of *our system of organic life* is to be placed in the midst of the period of primary strata.

"The earliest forms of life known to geology are not, as might perhaps be expected, plants, but animals; they are not of the lowest grade of organization merely; zoophyta far advanced in structure, (lamelliferous corals); brachiopodous bivalves, of three genera, were found by myself on Snowdon, but no *distinct* traces of plants. The *number* of species of this early fauna is extremely small, but there is about them no mark of inferiority,—no extraordinary simplicity.

"From this origin of organic life there is no break in the vast chain of organic development till we reach the existing order of things: no one geological period, long or short, no one series of stratified rocks, is everywhere devoid of traces of life; the world once inhabited has apparently never for any ascertainable period, been totally despoiled of its living wonders; but there have been many changes in the individual forms, great alterations in the generic assemblages, entire revolutions in the relative number and development of the several classes. Thus the systems of life have been varied from time to time to suit the altered condition of the planet, but never extinguished; the earth once freed from its early inadequacy to support life according to the appointed laws of life, has since been prolific of vegetable and animal existence.

"The *proportionate number* of organic forms has gone on even gradually (see my *Guide to Geology*,) augmenting from the dozen species of the Snowdon slates, through the twelve hundred and more species of the oolite, the four thousand forms of the tertiary eras, to the multitudes of existing things. The *change* of organic structure is also, in some degree, proportioned to the time elapsed; tried by the cephalopodous mollusca, we see perish first the orthoceratites, then the Belemnites and Ammonites, while nautilus and sepia exist to represent this class in existing nature. The development of the different classes of animals is usually thought to exhibit a similar relation, as if nature had been continually improved from the moment of the origin of life; but this opinion is, if taken generally, one of the least certain of all the general notions now current, because of a radical defect in the reasoning. This defect consists in assuming into one induction the terrestrial and marine races of animals. Now, as the higher forms of life are *terrestrial*, and the remains of terrestrial things are only by accident mixed with the spoils of the sea, it is no wonder that mammalia and birds are rarely suspected even to occur among the buried spoils of the ocean. However, the Didelphis of Stonesfield is enough to cast a doubt on this notion, which should be more critically examined by a logical process. It should be inquired what is the order of development among the marine races on one hand, and the terrestrial groups on the other. The latter are too few, in a fossil state, to justify any decision; the former supply certain evidence. The order of development is, zoophyta and brachiopodous conchifera; the same groups, with the addition of plagimyonous conchifera, gasteropoda, cephalopoda, fishes; the same, with the addition of reptiles; the same, with one solitary didelphis; the same, without didelphis or any other quadruped; the same, with marine and terrestrial quadrupeds; existing creation, "Is the present creation of life a continuation of the previous ones,—a term of the same long series of communicated being?—I answer, Yes! But not as the offspring is a continuation of its parent. The present crocodiles are not thus derived from the Teleosaurus of Caen, by indefinite change through time and circumstance, as St. Hilaire's and Lamarck's, (and Goëthe's?) speculations might lead to suppose; but the existing forms of life *resemble* those of times gone by, because the general aspect of the physical conditions of the world has always been, since the origin of life on the globe, decidedly analogous, and they *differ* from them because the co-relation of life and physical conditions is strict and necessary, so that all the variations of these conditions are represented in the phases of organic structure, while all their general agreements are also represented by the conformity of the great principles of structure in the beings of every geological age, and the often repeated analogies and parallelisms of series of forms, between different geological periods, which we now hail as a law of nature, when comparing America or Australia with Africa, Asia, or Europe.

"We are not, then, in a different system of nature, properly so called, from those which have been created and have been suffered to pass away before the birth of man! but in a forward part of the same system, whose law of progression is fixed, though from time to time the signification of the terms varies. The full and complete system of organic life now on the globe includes all the effects of land and sea, warmth and cold, divided regions, and all the other things which are the diversifying causes of nature; and it is no wonder if before this land was raised from the deep, and the present distinction of natural regions was produced, there was not the same extreme variety of natural productions. Till that variety was occasioned on the globe it was not the fitting place for intellectual man that now it is; for surely among the other uses and co-relations of the visible creation this is one; by its inexhaustible diversity and ever-growing newness to interest with a perpetual charm the growing mind of a rational being, and lead him by a flowery path to the full cultivation of the divine thing within him, which raises him above all that his senses make known, and thus to fit him for the highest contemplation of which he is capable, viz., the relation which he bears to the unseen Author of all this visible material world.

"Thus, to the mind of a geologist nature is one glorious book; one system of appointed and associated law, independent of time and exempt from change, but operating under conditions which vary with time and place; the past has prepared the present, the present explains the past and points to the future."

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JOHN W. PARKER, ST. MARTIN'S LANE.